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THESIS

DEVELOPING A KNOWLEDGE MANAGEMENT FRAMEWORK TO ASSIST WITH CURRENT USMC INFORMATION MANAGEMENT PRACTICES

by

Petrus R. Johnson

September 2010

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DEVELOPING A KNOWLEDGE MANAGEMENT FRAMEWORK TO ASSIST WITH CURRENT USMC INFORMATION MANAGEMENT PRACTICES

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ABSTRACT

As can be evidenced by the conducting of Annual Knowledge Management Conferences, held in Washington, DC (most recently the DoD Knowledge Management Conference, October 2009), DoD understands the value of Knowledge Management (KM). The Air Force, Army and Navy appear to have created healthy knowledge sharing environments and practicing KM at mature levels; however, the Marine Corps is having a difficult time integrating the practice of KM into daily operations. While the Marine Corps Warfighting Publication (MCWP) 3-40.2 offers a methodology for how four classes of information should flow through the Information Hierarchy, to date, there is no published, standardized framework for how to adequately manage knowledge that exists in the Information Hierarchy, hence, the need for an actionable KM Framework that the Marine Corps can use to assist with current Information Management practices. The focus of this thesis is to assess current KM practices across the DoD, identify KM best practices in industry, as well as across the DoD, and ultimately develop a KM Framework that will leverage the powerful dynamics of Knowledge Flow Theory to assist in bridging the knowledge gap in the current Marine Corps Information Hierarchy.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFKN	Air Force Knowledge Now
AFMC	Air Force Materiel Command
AKO	Army Knowledge Online
BCKS	Battle Command Knowledge System
BPR	Business Process Reengineering
C-3PO	Create, Craft, Choose, Promote and Organize Framework
C4	Command, Control, Computers and Communication
CAC	Combined Arms Center
CALL	Center for Army Lessons Learned
CBR	Case Based Reasoning
CCIR	Commander's Critical Information Requirements
CIO	Chief Information Officer
COI	Community of Interest
CONOPS	Concept of Operations
COP	Common Operational Picture
CoP	Community of Practice
DoD	Department of Defense
DON	Department of the Navy
DSM	Decision Support Matrix
DST	Decision Support Template
HADR	Humanitarian Assistance and Disaster Relief
HQ	Headquarters
IA	Intangible Assets

IDEA	Innovative Development Through Employee Awareness Program
IM	Information Management
IMO	Information Management Officer
IMP	Information Management Plan
IPDS	IDEA Program Data System
IT	Information Technology
KCO	Knowledge Centric Organization
KM	Knowledge Management
KPI	Key Performance Indicator
MAGTF	Marine Air Ground Task Force
MCCDC	Marine Corps Combat Development Command
MCWP	Marine Corps Warfighting Publication
MS	Microsoft
NAVMED MPT&E	Navy Medicine Manpower, Personnel, Training & Education Command
NETC	Naval Education and Training Command
NKO	Navy Knowledge Online
NPDC	Navy Personnel Development Command
PDE&A	Plan, Decide, Execute, and Assess
ROI	Return on Investment
SECNAVINST	Secretary of the Navy Instruction
SNMP	Simple Network Management Protocol
SQL	Structured Query Language
SWOT	Strength-Weakness-Opportunity-Threat Analysis

TNT	Tactical Network Testbed
TRADOC	Training and Doctrine Command
TTP	Tactics, Techniques and Procedures
USMC	United States Marine Corps

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I. INTRODUCTION

Marine Corps Information Management is performed in accordance with Marine Corps Warfighting Publication (MCWP) 3-40.2, which offers a methodology for how four classes of information [Raw Data, Processed Data (Information), Knowledge, Understanding] should flow through the Information Hierarchy. Knowledge is considered one of these classes of information; however, the fundamental problem is that knowledge is distinct from both data and information. As demonstrated by Nissen, in Harnessing Knowledge Dynamics (2006), knowledge enables action, and is required at every level of the information hierarchy. Currently in Marine Corps Information Management, knowledge is only considered "a representation of what is happening," (MCWP 3-40.2, 2002) and, as a result, is undervalued as an asset that can enable action at every level of the Information Hierarchy.

Knowledge has been defined as, “the preeminent economic resource, more important than both raw material and money” (Stewart, 1997). Considering knowledge as an economic output and coupling this with the knowledge-based view of the firm which suggests that the firm should, “focus upon knowledge as the most strategically important of the firm’s resources” (Grant, 1996), one comes to see the importance of knowledge and the potential benefits derived from managing it well. Knowledge Management (KM) then, can be defined as the attempt of an organization to identify and distinguish knowledge from information, assess the value added of this knowledge in terms of actionable achievement of organizational objectives, and the pursuit of the appropriate amount of resource allocation to the most valuable knowledge-based assets throughout the organization (Nissen, 2006; Davenport et al., 1998). Essentially, KM is the practice of managing intellectual capital.

As can be evidenced by the conducting of Annual Knowledge Management Conferences, held in Washington, DC (most recently the Department of Defense (DoD) Knowledge Management Conference, October 2009), the Marine Corps, as well as DoD, understands well the value of KM, but has a difficult time integrating its practice into

daily operations. While MCWP 3-40.2 offers a methodology for how four classes of information should flow through the Information Hierarchy, to date, there is no published, standardized framework for how to adequately manage knowledge which exists in the Information Hierarchy, hence the need for a KM Framework, which the Marine Corps could use to assist with current Information Management practices.

Numerous projects are currently being touted as KM successes, but seemingly are only operational adaptations of information systems and Web 2.0 trends, that improve the ability of the Marine Corps and DoD to both process information faster and better link disparate information and data to the personnel who need it. While these accomplishments are certainly valid achievements in our information-centric age of warfighting, they only address the abilities of Information Technology (IT) to enhance information flows, not knowledge flows. Knowledge Flow Theory can assist in determining how and where knowledge should flow through an organization, as it leads one to make a distinction between data, information, and knowledge, as well as, the different types of knowledge required to enable timely and accurate decisions that impact operations. Additionally, developing a standardized KM Framework that embraces Knowledge Flow Theory offers great potential to assist in the management of information, as well as, identify where current knowledge rests in the Information Management (IM) process.

The focus of this thesis is to assess current knowledge management practices across the DoD, identify KM best practices in industry, as well as across the DoD, and ultimately develop a KM Framework that will leverage the powerful dynamics of Knowledge Flow Theory to assist in bridging the knowledge gap in the current Marine Corps Information Hierarchy.

To identify current knowledge management practices across the DoD, and identify KM best practices in industry, as well as across the DoD, this research seeks to answer the following questions:

1. How is the DoD currently addressing KM?

2. What steps are necessary for the United States Marine Corps (USMC) to advance its KM practice?

The following investigative questions are necessary in order to answer the above listed research questions:

IQ1: What is KM?

IQ2: What is the importance of KM to DoD?

IQ3: Who has developed KM programs within DoD?

IQ4: What constitutes successful KM programs?

IQ5: What metrics are being used to evaluate KM programs?

IQ6: How can the USMC KM practice be improved?

The balance of this thesis is organized as follows. Chapter II includes a review of existing literature. Chapter III discusses the research methodology. Chapter IV summarizes the results. Chapter V is a discussion of the key results and insights discovered during this research, and recommendations of key interventions that the USMC could act upon to advance its KM practices, as well as, suggestions for follow-on research.

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II. LITERATURE REVIEW

A. KNOWLEDGE

Tom Stewart (1997) asserts that knowledge is the most important factor of production in the modern economy. Thus, knowledge is the key to achieving competitive advantage. If we are to subscribe to this concept, then it goes without saying that we need to determine what exactly constitutes knowledge. What is knowledge? How does it, if at all, differ from information and data? Can it be possessed? How do we go about creating, storing, and disseminating knowledge? All of these are key issues in being able to successfully manage knowledge.

B. DEFINITION OF KNOWLEDGE

Numerous authors have attempted to define knowledge in the context of either organizational learning or knowledge management. Knowledge has been defined as, “the preeminent economic resource, more important than both raw material and money” (Stewart, 1997). Companies can achieve competitive advantage by managing knowledge better than their competitors. Alavi and Leidner (2001) posit that, "knowledge is information possessed in the mind of individuals: it is personalized information (which may or may not be new, unique, useful, or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgments." Key to this view is that in order to effectively distinguish between information and knowledge, one need not worry about the content of knowledge, how it is structured, whether it is accurate, or even if it is useful, because the fact that it exists in an individuals' mind lessens the importance of all other attributes associated with knowledge. Additionally, drawing from the knowledge-based view of the firm, we have the assumption that, "knowledge is the critical input production and primary source of value" (Grant, 1996). The view here is that human productivity depends on knowledge, and further, that machines are, "simply embodiments of knowledge" (Grant, 1996). Davenport and Holsapple (2006) state simply that knowledge is, "the capacity to take action." This view

stems from the intangible assets (IA) framework put forth by Sveiby (1997), in which he believes that people are the only true agents in business, and further that all assets are merely the result of human action. This view helps to elucidate the importance of intellectual capital as a management objective. Lastly, from a DoD perspective, the Defense Acquisition University (DAU) Press has put forth its own definition of knowledge in its publishing of, "The Knowledge Management and Information Technology (Know-IT Encyclopedia)." The definition states that knowledge is, "The ideas, understanding, and lessons that an organization has learned over time…knowledge is condensed information with context that has value for decision and action" (Pollock, 2002). Therefore, one comes to notice that there is no clear consensus on what the definition of knowledge should be. So, for the purposes of this thesis we would simply like to remind the reader of the widely accepted tautology of 'that which is known,' which can further be supported by a definition of knowledge in Webster's dictionary. In other words, knowledge is the result of what is gained through the process of learning.

C. KNOWLEDGE DISTINCTION

To begin to grasp the understanding that knowledge is distinct from both information and data, one must be aware of the hierarchy of data, information, and knowledge. Popular among scholars is the view that data precedes information, and knowledge follows information. The implication is that knowledge is more powerful than both data and information as can be seen in Figure 1.

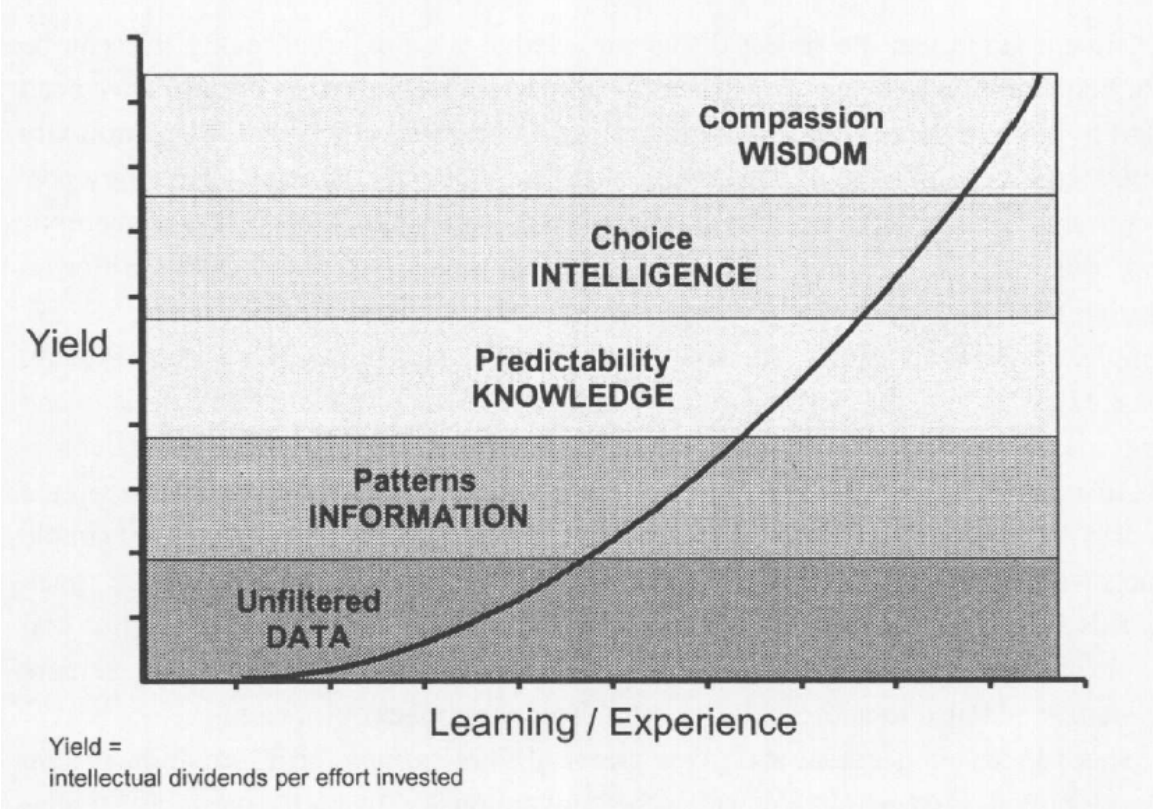

Figure 1. Knowledge Hierarchy (From Tuomi, 1999)

Tuomi (1999) explains that in this traditional view data is structured to become information and that information becomes knowledge when context or meaning is added. Considering from the figure that yield increases as one goes up the hierarchy, the implication is that, "data are something less than information and that information is less than knowledge...Moreover, it is assumed that we first need to have data before information can be created, and that it is only when we have information that knowledge can emerge" (Tuomi, 1999). Tuomi goes on to say that intelligence follows knowledge, as knowledge leads one to make certain choices. Finally, wisdom is the result of a pattern of intelligent behavior.

In addition to the knowledge hierarchy, we must also distinguish between two different types of knowledge: explicit and tacit. In a sense, the dimensions of explicit and tacit knowledge can be viewed as a continuum, having each on opposite ends of the knowledge spectrum. Often times scholars have represented this continuum on Cartesian

graphs with both explicit and tacit being present on the same axis of a graph. Generally speaking, explicit refers to knowledge that has been codified or captured in written form. Alternatively, tacit refers to knowledge that exists in one's head, or is implicitly possessed by an entity, and is developed over time.

Consistent with the aforementioned view of the knowledge hierarchy we see in Figure 2 that the USMC has adapted a similar view of this hierarchy.

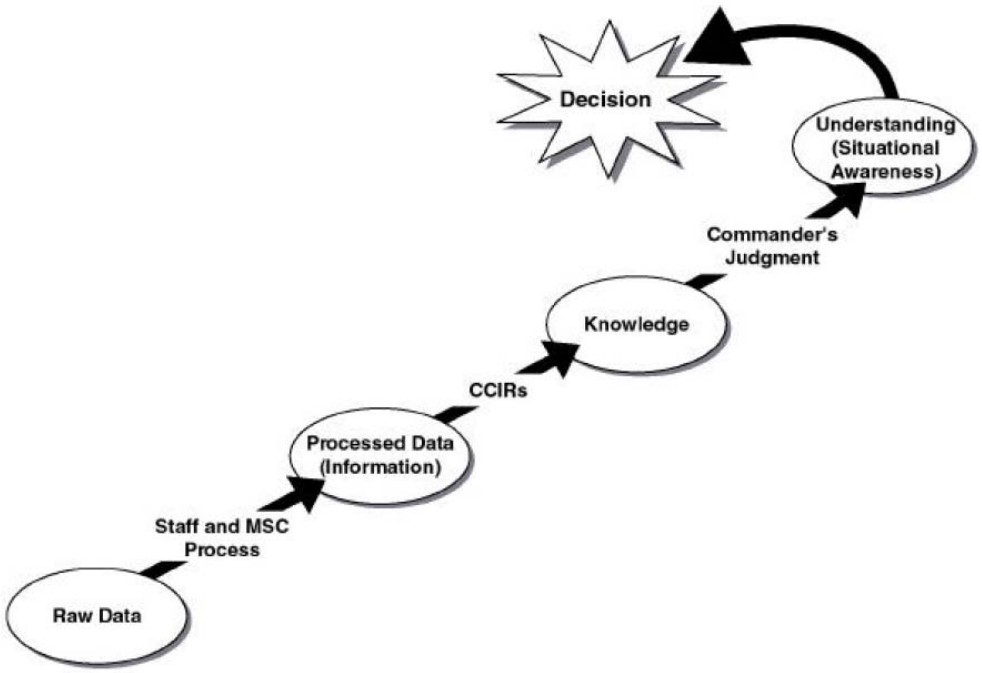

Figure 2. USMC Information Flow (From MCWP 3-40.2)

In the figure, we see that raw data represents pieces of information that need to be processed before any value can be derived. Information comes as a result of, "organizing, correlating, comparing, processing, and filtering raw data and making it readily understandable to the potential user" (MCWP 3-40.2, 2002). Knowledge then comes from a process of analysis and integration of Commander's Critical Information Requirements (CCIR) that have been answered. In essence, knowledge "brings meaning and value and serves as a representation of what is happening" (MCWP 3-40.2, 2002). Ultimately, a synthesis of data, information, and knowledge occurs as the Commander

judges both new and already possessed knowledge, leading to the development of situational awareness and finally a decision on what to do with knowledge acquired. Once again, although different in appearance, we see that this view of information flow through the knowledge hierarchy is consistent with mainstream scholars and their view of the data, information, knowledge hierarchy and the belief that knowledge is more important than both data and information. It is important to point out to the reader that while this view is most popular among scholars, it is not the only view.

Nissen (2006) drawing from Tuomi (1999) discusses that of an inverted hierarchy, adding the concept of directionality in terms of knowledge flow. That is to say that knowledge must come before information can be created which can be turned into data. Figure 3 illustrates this concept and helps to explain the producer/source view and its complementary consumer/receiver view.

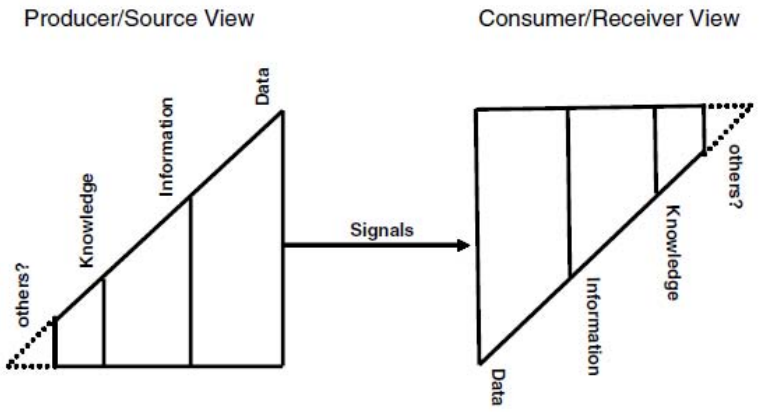

Figure 3. Knowledge flow directionality (From Nissen, 2002a)

The producer/source view subscribes to the inverted hierarchy view believing that knowledge is necessary for the production of information which is eventually turned into data. The consumer/receiver view, on the other hand, takes the more traditional view that data comes before information and subsequently information is created from contextual data, which becomes knowledge when action is enabled. Important to note is

that, "there is directionality to knowledge as it flows from producer or source to consumer or recipient" which helps to explain the coexistence of both views (Nissen, 2006).

D. KNOWLEDGE FLOW THEORY

1. Knowledge Spiral

Many models, theories, and frameworks have been used to describe how knowledge flows in an organization. Nonaka and Takeuchi (1991) developed by far the most widely known and influential models (The Spiral of Knowledge) describing a spiral pattern of interactions between the tacit and explicit domains of knowledge. Table 1 represents this spiral of interactions as they are associated with accompanying knowledge flow processes.

Knowledge Flow Dimension	Knowledge Flow Process
Tacit to Tacit	Socialization
Explicit to Explicit	Synthesizing
Tacit to Explicit	Articulation
Explicit to Tacit	Internalization

Table 1. Knowledge spiral (After Nonaka, 1991)

1) While tacit to tacit is most certainly not exclusive to individuals, this form of social activity is most often accomplished when one individual interacts and shares knowledge directly with another. An operational example of this is the common occurrence of duty or job turnovers (when one member replaces another at a certain position for varying durations) in a military context. This type of turnover is highly valued as one is able to imitate and practice, while getting questions answered and necessary feedback from the 'expert.' Although highly valued this type of knowledge flow is organizationally limited as, "their knowledge never becomes explicit, and is

therefore not easily leveraged by the organization as a whole" (Nonaka, 1991). In essence, the power leveraged remains with the individual and is not easily realized among the organization.

2) Explicit to explicit is probably the most common type of knowledge domain interaction as individuals fuse disparate sources of knowledge and information together either physically or electronically to come up with new knowledge. Once again, the knowledge base of the individual grows but that of the organization remains untouched or generally non-extended.

3) Nonaka (1991) argues that when tacit and explicit interact something powerful happens. He goes on to explain that the one who possesses the knowledge is able to, "articulate the foundations of their tacit knowledge, thereby converting it into explicit knowledge, allowing it to be shared" with the organization (Nonaka, 1991). This view is complementary to that of Nissen (2006) in which he states that, "the sticky nature of tacit knowledge is a mixed blessing…on one hand, it supports competitive advantage; on the other, it restricts knowledge flows within one's own organization." Because tacit knowledge is based upon experience, time, and is so difficult to articulate, being able to convert this knowledge into explicit form makes the knowledge readily available and easy to transfer, as its ability to be duplicated becomes infinitesimal in degree.

4) Explicit to tacit is synonymous with the development of new tacit knowledge based upon knowledge that has been shared in explicit form. As Nonaka puts it, "as new explicit knowledge is shared throughout an organization, one begins to broaden, extend, and reframe their own tacit knowledge" (Nonaka, 1991). Simply put, "where knowledge flows, learning takes place" (Nissen, 2006).

2. Knowledge Flow Strategy

Ribiere and Roman (2006) describe knowledge flows through an agreed upon typology that defines two strategies for knowledge flows: codification vs. personalization. Through independent research studies the authors attempt to discern, “how people obtain and/or share the knowledge that they need to perform their work” (Ribiere and Roman, 2006). In today’s information-centric age of operations many

organizations rely heavily upon the use of information technology. Here is where the codification strategy is employed most often, as its main purpose is to collect and disseminate knowledge and information throughout the organization. According to Davenport and Prusak (1998), "the aim of codification is to put organizational knowledge into a form that makes it accessible to those who need it. It literally turns knowledge into a code (though not necessarily a computer code) to make it as organized, explicit, portable, and easy to understand as possible." The codification strategy is generally employed in a fashion where knowledge is stored in databases (disparate and/or centralized) where it is accessed most often using the 'people-to-document approach.' In other words, knowledge is extracted from individuals who possess it, made explicit in form, and disseminated for the purposes of reuse. In contrast, the personalization strategy focuses on leveraging relationships and building networks for people to share their tacit knowledge. Undoubtedly this strategy can be approached with the use of the computer as well; however not in the same fashion as the 'people to document approach', as the focus is, "on dialogue between individuals as opposed to knowledge in a database" (Ribiere and Roman, 2006). Collaborative technologies are often used to support the sharing of knowledge. Zack and Michael (1996) discuss collaborative technologies as they support the personalization approach highlighting that,

> in contrast to distributive applications, the repository associated with collaborative applications is a by-product of the interaction, rather than the primary focus of the application. This repository of messages is dynamic and its content emergent. The ability to capture and structure emergent communication within a repository provides a more valuable, enduring, and leverageable knowledge by-product than the personal notes or memories of a traditional conversation or meeting. Collaboration technologies, therefore, can support a well-structured repository of explicit knowledge while enabling the management of tacit knowledge. (Zack and Michael, 1996)

The results of this study, highlighting findings of the government, for-profit, and nonprofit sectors will be discussed later in this chapter, as we discuss Information Technology (IT) and its place in KM practice, as it has the potential to help confer competitive advantages to those who employ it appropriately.

3. Knowledge Flow Visualization

Nissen (2002, 2005) extends Nonaka's model from that of two dimensions to a four dimensional model better enabling us to visualize knowledge flow patterns. The two dimensions presented by Nonaka are 1) the explicit-tacit distinction, which Nissen (2006) refers to as one dimension known simply as explicitness; and 2) ontological, again more simply defined by Nissen (2006) as reach, thereby identifying levels of social interaction as can be seen in the knowledge flow process column of Table 1. The additional two dimensions extended by Nissen include life cycle and flow time. As stated in his text, "life cycle refers to the kind of activity (e.g., creation, sharing, application) associated with knowledge flows; and flow time pertains to the length of time (e.g., minutes, days, years) required for knowledge to move from one person, organization, place, or time to another" (Nissen, 2006).

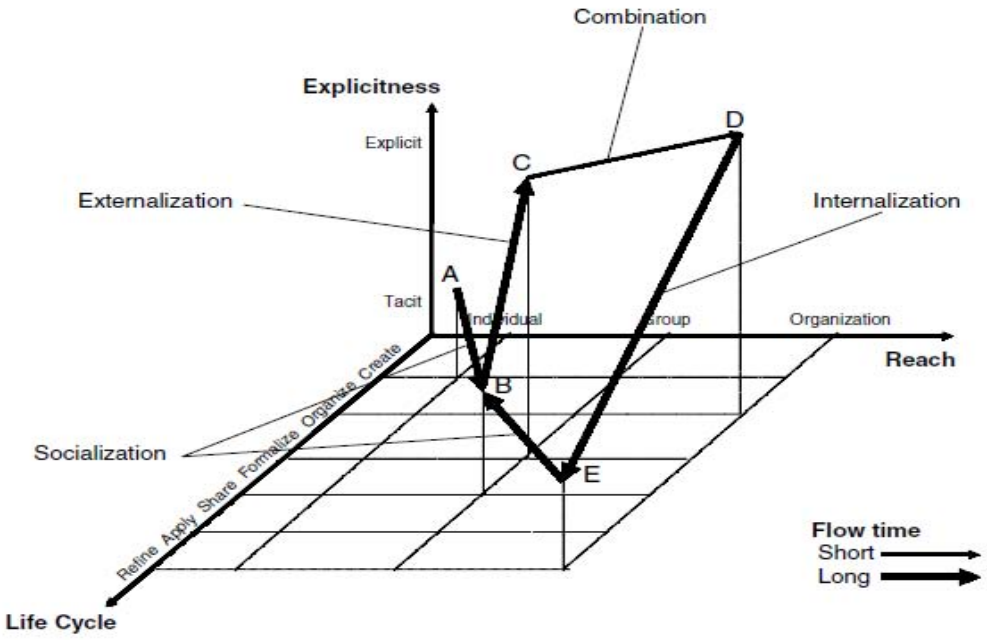

Figure 4. Multidimensional knowledge-flow visualization (From Nissen, 2005)

In Figure 4, we see all four dimensions come together, "to visualize a representative knowledge flow from this well-known theory" (Nissen, 2006). Starting at coordinate A, we have tacit knowledge created by an individual. As the socialization process occurs we move from A to B which is representative of tacit knowledge being shared among a group. As explained earlier, this knowledge has potentially more power but is hard to capitalize on until it can be converted into an explicit form. This leads us to coordinate C, where the externalization process occurs as we move towards explicit knowledge that has been formulated by a group. Up to this point we can see that the vectors used to delineate knowledge flows have been relatively bold or heavy signifying the long (slow) flow time associated with each knowledge flow process. Also, key to point out here is the association with Table 1, as we see that the movement from tacit to explicit has covered the two knowledge flow processes of socialization and articulation from the knowledge spiral as adapted from Nonaka (1991). Moving from coordinate C to D, we end up at explicit knowledge that has been organized by the organization. This particular knowledge flow process has occurred relatively fast as can be seen by the narrow vector representing short flow time. This process of knowledge combination is synonymous with the knowledge spiral process of synthesizing. The speed associated with this process can be explained by the nature of explicit knowledge, which is relatively easy to articulate and transfer when compared to that of tacit knowledge. Finally, moving from coordinate D to E we see the culmination of numerous codified products that have been internalized by individuals throughout the organization leading to the development of tacit, organizational knowledge that is being refined, which is the main ingredient for innovation and the creation of new knowledge, as opposed to simply knowledge reuse which is the current state of knowledge management in many of today's organizations. It is here we feel knowledge flow theory can make its biggest contribution to knowledge management practices as the theory can assist in determining how and where knowledge should flow through an organization, as it leads one to make a distinction between data, information, and knowledge, as well as, the different types of knowledge required to enable timely and accurate decisions that impact operations. This

thesis will present more knowledge flow visualizations as we examine future case studies and summarize our findings of knowledge flow pathologies and recommend interventions on how knowledge flow issues can be addressed.

E. KNOWLEDGE AND TECHNOLOGY

IT is pretty much commonplace now among KM initiatives. As more and more organizations turn to IT to be the 'silver bullet,' it becomes imperative for us to have an understanding of the knowledge life cycle and how IT interacts in both supportive and performative ways. For this, we will examine the knowledge life cycle as presented by Nissen (2006), discussing how some forms of IT support KM better than others, Alavi and Leidner (2001), which introduces a framework for the analysis of the role of an information system in organizational knowledge management processes, and the study performed by Ribiere and Roman (2006), in which government, for-profit, and nonprofit organizations were analyzed to determine what types of technology applications were used by people to obtain and share knowledge, as well as perform their daily duties.

Nissen warns that, "information technology is helpful and necessary but not sufficient for knowledge to flow" (Nissen, 2006). KM is about people, processes, and technology. It is imperative for any KM initiative to be approached in terms of all three in order for knowledge to properly flow. Much of the reason for this warning about technology is due to the fact that certain types of knowledge are supported by IT better than other types of knowledge.

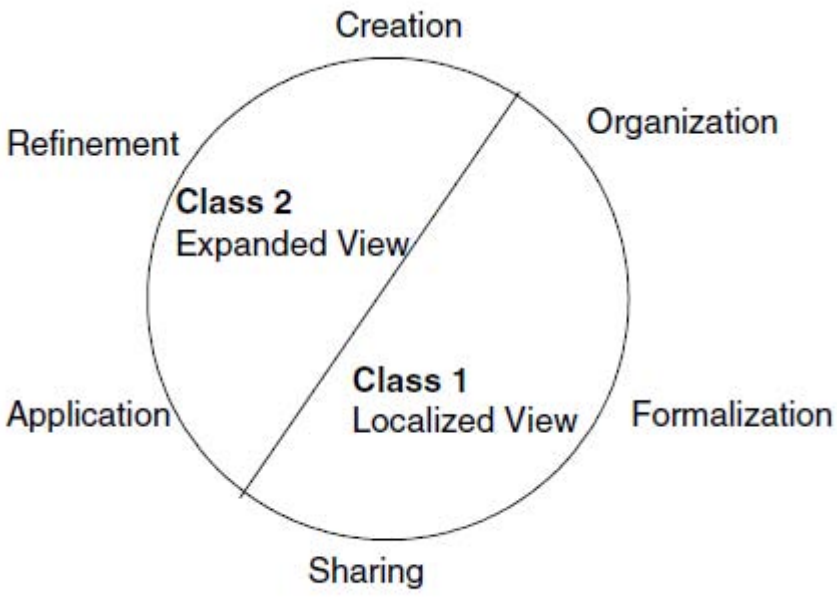

Figure 5. Knowledge life cycle (From Nissen et al., 2000)

As seen in Figure 5, there are two different classes of knowledge; that of the localized view in which its three knowledge activities share the quality of being supported well by IT, and the expanded view with its three knowledge activities sharing the characteristic of being supported well by people who perform the activities and not so much by IT. Just as in the multidirectional knowledge flow diagram the life cycle here begins with knowledge creation and ends with knowledge refinement; however, the life cycle is not limited to flowing in a single direction.

Examples of supportive technologies for the localized view of the life cycle are repositories for building knowledge maps or networks in the organization phase, Web sites that house bodies of knowledge and cater to communities of interest/practice for the purposes of knowledge formalization, and the relatively new use of Web 2.0 technologies used during the sharing phase to help distribute knowledge to individuals both locally and those in remote locations. The expanded view has the application phase in which people are necessary for decision making. Automation systems are helpful in this phase, but most humans seem to have an inherent distrust of technology when it comes to making decisions. Knowledge refinement generally applies to an individual's internalization of

some form of explicit knowledge, thereby turning it into personal tacit knowledge. Again, IT generally does not support this phase well. Finally, as mentioned earlier, the notion is that knowledge is something that exists in the minds of people; therefore, IT has a very limited role in this refinement phase as well. Hence, "most IT plays a supportive role in the organization, whereas people play most of the performative roles" (Nissen, 2006). The only caveat to this principle is found through the use of simulation technology which offers a "trial and error approach to learning," thereby accomplishing learning "without having to bear the consequences of faulty decisions," consequently "facilitating learning as well as doing through virtual practice," allowing it to be employed during multiple phases of the knowledge life cycle (Nissen, 2006).

According to Alavi and Leidner (2001), in order to formulate a knowledge management strategy, organizations need to assess and understand their knowledge position and existing intellectual resources before they can assess the role of information technology in facilitating knowledge management. Building on the view of organizations as "social collectives and knowledge systems," the authors developed a framework for analyzing the role of an information system (Alavi and Leidner, 2001). The four knowledge processes comprising the framework include 1) creation; 2) storage/retrieval; 3) transfer; and 4) application. The following table summarizes well each of the four processes and the potential role IT could serve in each.

KM Processes	Knowledge Creation	Knowledge Storage/Retrieval	Knowledge Transfer	Knowledge Application
Supporting IT	Data mining Learning tools	E-bulletin boards Knowledge repositories Databases	E-bulletin boards Discussion forums Knowledge directories	Expert systems Workflow systems
IT Enables	Combining new sources of knowledge Just in time learning	Support of individual and organizational memory Inter-group knowledge access	More extensive internal network More communication channels available Faster access to knowledge resources	Knowledge can be applied in many locations More rapid application of new knowledge through workflow automation

Table 2. Knowledge Management Processes and the Potential Role of IT (After Alavi and Leidner, 2001)

1. Knowledge Creation

The authors, drawing from (Pentland, 1995) posit that knowledge creation involves developing new content or replacing existing content within the organization's tacit and explicit knowledge. In essence, knowledge creation is both a social process which includes activities like sharing and collaboration, as well as a personal activity involving internalization of existing knowledge and development of new tacit knowledge as a result of new insight. This view is in concert with Nonaka's knowledge spiral. It matches succinctly the four modes of knowledge creation discussed by (Nonaka, 1994): socialization, externalization, internalization, and combination. IT capable of

accelerating the growth of knowledge creation include, "systems designed for support of collaboration, coordination, and communication processes," email, and intranets (Alavai and Leidner, 2001).

2. Knowledge Storage/Retrieval

In terms of knowledge storage/retrieval, Alavi and Leidner discuss the concept of organizational memory which includes, "knowledge residing in various component forms, including written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes and tacit knowledge acquired by individuals and networks of individuals" (Tan et al., 1999). In addition to the types of IT listed in Table 2 that help to support knowledge storage/retrieval, computer storage technologies coupled with sophisticated retrieval algorithms and techniques (e.g., SQL), and also database management systems can be used to help alleviate the problem of organizational memory loss.

3. Knowledge Transfer

Knowledge transfer is arguably the most important of the four processes in terms of knowledge flows. As stated by the authors, "transfer occurs at various levels: transfers of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, between groups, across groups, and from the group to the organization" (Alavi and Leidner, 2001). The most important aspect of this phenomenon is that knowledge gets transferred to those who need it, when they need it, regardless of their physical location. Literature abounds on this topic of knowledge transfer and Gupta and Govindarajan (2000) have popularly conceptualized it in terms of five elements: "1) perceived value of the source unit's knowledge, 2) motivational disposition of the source (i.e., their willingness to share knowledge), 3) existence and richness of transmission channels, 4) motivational disposition of the receiving unit (i.e., their willingness to acquire knowledge from the source), and 5) the absorptive capacity of the receiving unit, defined as the ability not only to acquire and assimilate but also to use knowledge."

Because knowledge and technology is the focus of this section, we want to hone in here on the importance of element 3: the existence and richness of transmission channels.

There are formal and informal, as well as personal and impersonal types of transfer channels. Informal mechanisms include the likes of unscheduled meetings, informal seminars, or just conversations between individuals that may happen on a coffee break. While results of these informal meetings can be effective in terms of socialization, they prove quite ineffective in ability to transfer knowledge, mainly because the knowledge being created and shared is not formally coded. Because of this, there is no real way to ensure that the knowledge gets transferred from one individual to others who may need the same knowledge. More formal mechanisms include training sessions and planned tours, which do well at knowledge distribution/sharing, however, they dangerously lack any real creativity since most presentations are quite standardized for delivery. Personal channels such as apprenticeships or military personnel turnovers are effective at distributing context specific knowledge, whereas impersonal channels such as knowledge repositories are most effective at transferring generalized knowledge.

As stated by Alavi and Leidner (2001), IT can support all four forms of knowledge transfer, but it has mostly been applied to two types: informal (e.g., Lotus Notes discussion databases) and impersonal (e.g., knowledge maps and corporate directories). Other forms of IT that contribute to knowledge transfer are that of intelligent agent software utilized to help develop interest profiles of members of an organization, and are then used to link interested members of similar topics; video technologies which can be utilized to provide visual images of some sort of tacit knowledge that is either difficult to articulate, or simply better understood if seen as opposed to being read; and social media which helps to harness the power of knowledge organizations which are characterized by, “weak hierarchies, dense lateral connections, low departmental walls, and openness to the environment” (Achrol and Philip, 1999). Even an organization without all the characteristics of a knowledge organization can excel in knowledge transfer through the use of social media as it can, “increase knowledge transfer by extending the individual’s reach beyond the formal communication lines” (Alavi and Leidner, 2001).

In further relation to social media and knowledge transfer via knowledge management, work Done by Cross, Parker, Prusak, and Borgatti (2001) identifies four dimensions of network ties which influence a firm's KM capability:

> 1) Knowledge: "knowing what someone else knows" when managers face a problem or opportunity; 2) Access: being able to contact and secure useful information for an actor in a timely fashion; 3) Engagement: the expert understands the problem as experienced by the seeker and then adapts his or her knowledge to the needs of the person information; and 4) Safety: ease in admitting a lack of knowledge.

The point is that carefully constructed organizational implementations of social media can help to extend mechanisms for formal and personal transfer channels through the use of IT, thereby extending networks, increasing communication channels, and providing near real-time access to knowledge resources, which is substantially faster than more traditional forms of supporting IT.

4. Knowledge Application

Rounding off the author's framework for analyzing of the role of an information system in organizational knowledge management processes, Alavi and Leidner (2001) posit that "IT can enhance knowledge integration and application by facilitating the capture, updating, and accessibility of organizational directives, codifying and automating organizational routines, and capturing and enforcing well specified organizational procedures." Examples of this can be seen in the publishing of corporate intranets in which more open access and document controls to corporate directives is given to employees; in the use of workflow automation systems that increase efficiency of workflows by decreasing communication and coordination which was formerly necessary among workers; and rule-based expert systems that allow the enforcement of organizational rules and procedures. Consider the following Case Based Reasoning (CBR) example:

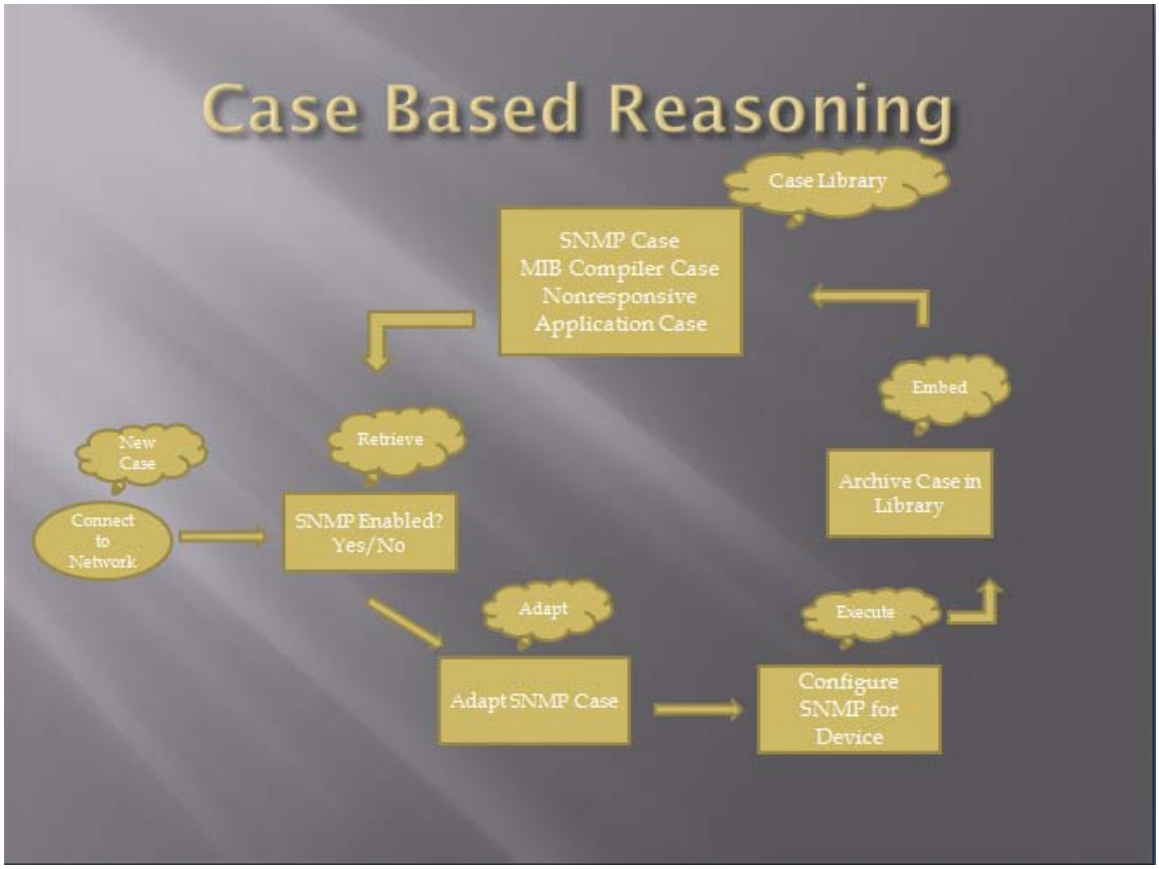

Figure 6. TNT 10-2 CBR Example (From Duke, Hayward, Johnson, 2010)

During a Tactical Network Testbed (TNT) experiment aboard the Naval Postgraduate School campus, during the winter quarter of 2010, our team continued to identify a repeating scenario during our exercise in which new users (computers) were attempting to connect to a network we were managing utilizing the Simple Network Management Protocol (SNMP). The figure illustrates a CBR approach to solving this recurring network management problem in which a rule-based expert system could be employed. Specifically:

1- The new case being presented is a random user attempting to connect to a network that we are managing.

2- The "If rule" is whether or not the device is SNMP enabled, and we go into our Case Library to see if a similar case exists?

3 – A similar case does exist, and we simply adapt that SNMP Case and move to execute what was previously done in this situation. In our case, the individual is made to configure the device for SNMP before being allowed to connect to the network.

4 – Finally, our case is archived and stored in the Case Library.

Here we see the power of an expert system that has essentially automated the archival and enforcement of well specified organizational rules.

Having reviewed the knowledge life cycle and discussing different technologies that support various forms of knowledge, we turn back to the Ribiere and Roman (2006) paper, in which government, for-profit, and nonprofit organizations were analyzed to determine what types of technology applications were used by people to obtain and share knowledge, as well as perform their daily duties. Recalling the knowledge flow strategies of codification and personalization outlined in the article, the following figure shows the results of strategic approaches taken by each sector.

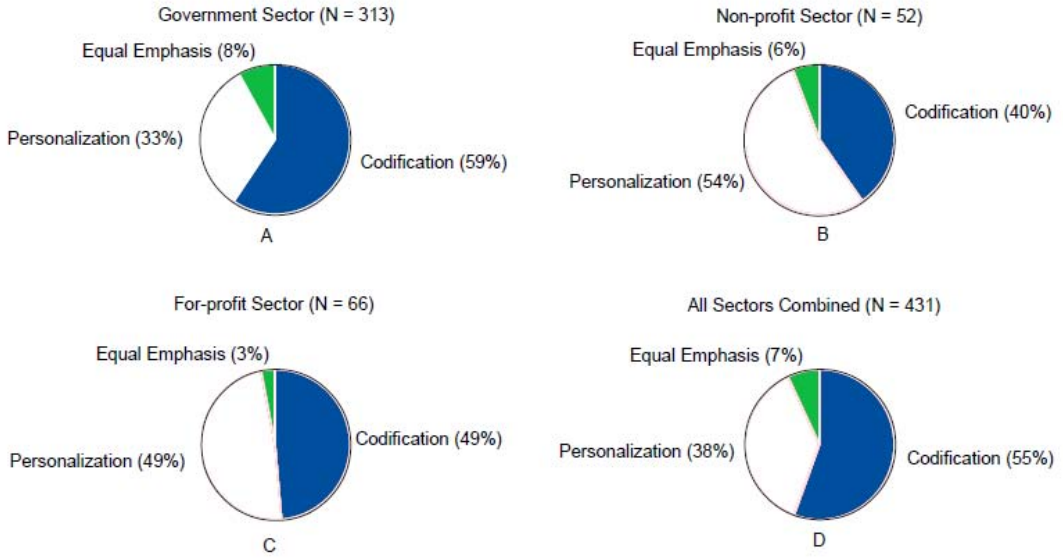

Figure 7. Codification and personalization factors as dominant strategic approaches for the flow of knowledge within the organization (From Ribiere and Roman, 2006)

The government sector and non-profit sector appear to be polar opposites as the emphasis of government users in predominantly codification at 59%, implying mainly the use of IT resources such as intranet/extranets, search engines, and information retrieval systems for knowledge flow, as opposed to non-profit workers preferring personalization at 54%, signifying less formal and explicit means of knowledge flow such as phone calls, teleconferencing, working groups, and communities of practice, thereby relying more on relationships and network formulation for knowledge to flow among members. Hansen et al. (1999) note that organizations are more effective when they emphasize only one of the strategies. The implication is that those trying to excel at both, risk failure at both. This postulation is seemingly true as the government and non-profit sectors respondents employing both are at 8% and 6% respectively. The for-profit sectors indicate that employment of each strategy is roughly split down the middle at 49% each, with only 3% of respondents indicating a balanced approach. Figure 7D depicts all three sectors combined.

While ultimately, the approach chosen depends heavily upon the strategy of the organization, it can be seen that results from this study present a sort of continuum in which the government and non-profit sectors are at opposite ends of the spectrum with the for-profit sector sitting in the middle. The data indicates that organizations realize the necessity of both approaches.

Furthermore, it can be seen that the three views of knowledge technology presented by Nissen (2006), Alavi and Leidner (2001), and Ribiere and Roman (2006) all complement each other. Nissen presents the knowledge life cycle in localized and extended views, emphasizing the ability of IT to contribute well to various stages of the life cycle. Alavi and Leidner present a framework that shows the knowledge life cycle in four different KM processes, subsequently showing how IT can both support and enable each of the four KM processes. Finally, Ribiere and Roman present knowledge flows in the form of two differing strategies of KM: codification vs. personalization, each encompassing elements of the knowledge life cycle, while also illustrating the forms of IT utilized to accomplish and perform tasks related to each strategy.

F. USMC INFORMATION MANAGEMENT (IM)/KNOWLEDGE MANAGEMENT

1. Information Management

The Information Management Program at every level of USMC command is utilized to facilitate the decision making of the Commander. Information Managers are responsible for providing a "timely flow of relevant information" to the Commander that assists him/her in anticipating and understanding changing conditions and their impact on operations (MCWP 3-40.2). Knowledge is in essence, acquired from many sources of information and data, in an attempt to ensure the information's accuracy. While multiple sources of information can improve accuracy, as well as, reduce errors, the reverse effect of information overload inevitably develops. Knowledge, which enables action, is what is needed, but not addressed in our current management of information. Undoubtedly, knowledge is important in this process, as it helps to lead the commander to the understanding that is necessary for sound decision-making.

The Marine Corps, pulling from the SECNAVINST 5000.36A, has defined IM as, "the planning, budgeting, manipulation and controlling of information throughout its life cycle. IM allows the Marine Corps to gather, share and learn from information and is focused on providing the right information at the right time in an understandable and useable format to enable decision making." The Information Management Officer (IMO) currently works with each staff section to create an Information Management Plan (IMP) that, "identifies procedures used to facilitate the delivery of quality information to those who need it in a format they can quickly understand" (MCWP 3-40.2). The decision making process of the commander is heavily influenced by the Plan, Decide, Execute, and Assess (PDE&A) cycle. It is during the planning phase of the operation that planned decisions are made which are to be carried out during the execution phase. Decision points result from these planned decisions that help to identify points in time or space where a commander expects he/she will have to make a decision. Tools used to support these processes are the decision support matrix (DSM) and the decision support template (DST) which lists the decision points previously identified. Marines are merely one

component helping to fight the single battle, and thus it is imperative that IM procedures enable the Corps to share critical and relevant information in support of joint, combined, and multinational operations. Ultimately USMC IM products, replete with relevant and comprehensible information are what are used to feed the common operational picture (COP) of joint and component commanders, helping them to maintain situational awareness, while controlling and dictating the tempo of operations against our adversaries.

2. Knowledge Management

The Marine Corps realizes the importance of KM and its potential to assist in the creation, storing, and dissemination of required knowledge, as can be evidenced by its working group of knowledge workers who meet annually at United States Marine Corps Information Management/Knowledge Management Conference. Unfortunately, the Marine Corps struggles with assigning Knowledge Managers to units due to limited resources. Additionally, as the Corps attempts to embrace KM, each unit is left to develop its own practices of KM because of the lack of a standardized USMC KM Framework.

Pulling from the Department of the Navy Knowledge Management Strategy, KM is defined as, "the integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase organizational performance." Defense Acquisition University has defined KM as, "the process for effectively applying intellectual capital (human, social, and organizational) to enable faster, better organizational decisions" (Pollock, 2002). While the definitions may vary, the implications are the same. KM has the capability to make USMC business and decision making processes better.

Research shows that the Corps is actively participating in various KM initiatives. To date, USMC KM initiatives appear to remain unit specific, as opposed to organizationally formalized. A standardized USMC KM framework will assist in providing USMC units with operationally relevant, industry and DoD-centric KM best practices and tools with which to make use of in their process of developing unit-level

KM strategies. Examples of the types of operations and kinds of missions that are relevant to knowledge and knowledge flows span the gamete to include: 1) joint task force operations in which a high level of situational awareness understanding is necessary for appropriate expeditionary warfare maneuvers to occur from ship to shore, 2) humanitarian assistance and disaster relief (HADR) missions in which hastily formed international military and diplomatic relationships and rapid decision making processes determine success or failure in getting necessary relief to those in need, 3) knowledge sharing among a small contingent of military defense lawyers significantly dispersed geographically around the globe that have a common mission of supporting more than 202,000 Marines, 4) in place combat turnovers of Marine units, 5) collaboration among communities of practice members, and 6) stopping the loss of organizational knowledge due to contract expirations and retirements. While the above listed scenarios are not all inclusive, they certainly provide us with a broad enough spectrum of KM oriented processes with which we can safely postulate that a KM framework for the Marine Corps should assist top leaders in their institutionalization of the discipline and further formalization of organizational education and practices.

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III. METHODOLOGY

Yin (2009) states that, "a case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident." The practice of KM is certainly a contemporary phenomenon (observable occurrence) that is absolutely abstract in nature, making it quite difficult to place in one context. Its practice is varied and its existence universal, both making any meaningful research of its topic most appropriately accomplished through the lens of case study.

The case study research method utilized for this thesis is intended to contribute to our knowledge of organizational knowledge management at both the unit and service levels of DoD, thereby, applying its findings toward development of a KM framework to be utilized by the USMC. The multiple cases being studied are both historical and contemporary in nature, and no possibility exists for the behavior of events studied to be manipulated. The comparative studies presented are exploratory, developing hypotheses and propositions; and also explanatory, "dealing with operational links needing to be traced over time," yet allowing one to draw relevant conclusions for contemporary practitioners (Yin, 2009).

A. COMPONENTS OF CASE STUDY RESEARCH

Yin (2009) identifies five necessary components of case study research: 1) a study's questions; 2) its propositions, if any; 3) its unit(s) of analysis; 4) the logic linking the data to the propositions; and 5) the criteria for interpreting the findings.

Component one of this research is accomplished with the formulation of the following two research questions, "How is the DoD currently addressing KM?" and "What steps are necessary for the Marine Corps to advance its KM practice?" The exploratory nature of question one is intended to advance extant research on the practice of KM throughout DoD. Through the analysis of service-level KM education programs, documented unit-level KM practices, and both unit and service-level information portals

this research seeks to answer the first research question. The explanatory nature of question two guides this research through the identification and analysis of past and current successful DoD KM initiatives, which allows for triangulation of observations and findings, leading to insight towards the development of a KM framework capable of guiding USMC KM practitioners.

The investigative questions developed leads to propositions (component two) put forth by this research, namely: Proposition 1: KM is operationally defined throughout DoD based upon each service's mission, thereby having implications as to how each service practices the discipline; Proposition 2: KM is important to the DoD and the DoD gains benefits from its practice; Proposition 3: KM practice has continuously evolved throughout the DoD; Proposition 4: The civilian sector and the DoD community is replete with examples of successful KM initiatives; Proposition 5: Metrics for evaluating KM initiatives, if existent, are varied throughout DoD; and Proposition 6: KM practice in the Marine Corps can be improved with the advancement of an organizational framework to be utilized by USMC knowledge workers. Research data gathered and realized will support or refute the above listed propositions.

The third component, unit(s) of analysis, is extremely important as it helps to define the cases to be studied. This research puts forth two units of analysis; that of unit-level KM initiatives and service-level KM initiatives.

The fourth component of the linking of logic to data will be accomplished by utilizing the (type 4) multiple-case (embedded) design. Each of the four services will serve as a single case with the two previously mentioned units of analysis embedded in each case. The strength of this comparative study will rest in the theoretical replications across each service while complemented by the literal replications known to exist within each service.

Drawing from Yin (2009), this study accomplishes the fifth component of interpreting a study's findings through pattern matching and logic modeling. The theoretical propositions that led to our research questions is relied upon to shape the

collection of our data which will be organized in a collection database. This method allows for the highlighting of unit and service-level similarities and divergences from which conclusions can be drawn and verified.

B. QUALITY AND RELIABILITY METRICS

Just as with any other type of research design the logical statements put forth by case study research should have its quality evaluated according to certain logical tests. The following table summarizes four tests that are common to any empirical social research along with the associated tactics necessary at each phase of research to ensure success.

TESTS	Case Study Tactic	Phase of research in which tactic occurs
Construct validity	❖Use multiple sources of evidence ❖Establish chain of evidence ❖Have key informants review draft case study report	❖Data collection ❖Data collection ❖Data collection
Internal validity	❖Do pattern matching ❖Do explanation building ❖Address rival explanations ❖Use logic models	❖Data analysis ❖Data analysis ❖Data analysis ❖Data analysis
External validity	❖Use theory in single-case studies ❖Use replication logic in multiple-case studies	❖Research design ❖Research design
Reliability	❖Use case study protocol ❖Develop case study database	❖Data collection ❖Data collection

Table 3. Case Study Tactics for Four Design Test (After Yin, 2009)

Construct validity seeks to, "identify correct operational measures for the concepts being studied" (Yin, 2009). This research establishes construct validity by making extensive use of multiple sources of evidence. Data collection has ensured a wide array of theoretical and DoD specific documents for support of conceptual study. Internal validity refers to the establishment of causal relationships and the ability to distinguish relationships caused by outside factors not dealt with by the research. Secondly, in terms of internal validity, there is the concern of incorrect inferences being

made from events not directly observed. Numerous inferences will be made by this research. Through pattern matching and logic modeling of KM best practices across DoD, internal validity is maintained as findings are appropriately replicated at the unit and service-levels of DoD. External validity is mainly concerned with the problem of, "knowing whether a study's findings are generalizable beyond the immediate case study" (Yin, 2009). Once again, replication logic in this research ensures that the focus remains on that of general findings of unit and service-level military organizations. Finally, reliability ensures that errors and biases are minimized. The use of the case study database helps to prevent any bias concerns with this research and the minimization of errors ensures that another investigator can use the same research procedures in repeating a case study on the same case, and arrive at the same conclusions (Yin, 2009).

C. RESEARCH LIMITATIONS AND BIASES

The major bias of this research is that the investigator is a member of the United States Marine Corps. The relation of findings to collected data, in addition to rigorous analysis mitigates this bias to the maximum extent possible. A significant limitation of this study is that the term "KM" has no universally accepted definition. Consequently, many looking to draw inferences and conclusions will differ in agreements and expectations due to varying practices of KM across the DoD, as well as the differing relations of KM benefits to each service based upon that service's mission requirements and mission capabilities. Another limitation to this research is that no data is collected by means of observations, interviews, or surveys from current DoD KM practitioners. However, the documents collected, tools evaluated, and Web portals visited are the most current in publication and use by DoD KM practitioners, thereby increasing the validity of inferences made and findings reached which mitigates further the limitations associated with the absence of first-hand observation, interviews, or survey usage.

IV. ANALYSIS

Net-centricity is a buzz-word throughout DoD today. It implies that through networking, DoD will be able to link components of the Department, as well as organizations within with "complementary core competencies" that will enable the Total Force to become more than the sum of its parts (NDS, 2008). The goal of net-centricity is to, "break down barriers and transform industrial-era organizational structures into an information and knowledge-based enterprise" (NDS, 2008). Thus this transformation to a net-centric force requires "fundamental changes in processes, policy, and culture," all of which KM boasts significant abilities to achieve. Are current DoD KM initiatives contributing to this transformation? The answer to that question rests in the successfulness of the initiatives undertaken.

Davenport et al. (1998) study 31 knowledge management projects in 24 companies, and identify four indicators of success, in addition to eight critical success factors for KM projects. The following table summarizes each of the indicators of success and the critical success factors. Reflected in the table also is the identification of the four factors that seemingly matter the most, as indicated by their being underlined.

Indicators and Factors of Successful KM Projects

Success Indicators	Critical Success Factors
1. Growth in the resources attached to the project 2. Growth in the volume of knowledge content and usage 3. The likelihood that the project would survive without the support of a particular individual or two 4. Some evidence of financial return	1. Link to economic performance or industry value 2. Technical and organizational infrastructure 3. Standard, flexible knowledge structure 4. Knowledge-friendly culture 5. Clear purpose and language 6. Change in motivational practices 7. Multiple channels for knowledge transfer 8. Senior management support

Table 4. Indicators and Factors of Successful KM Projects (from Davenport et al., 1998)

The indicators and factors of success listed above played a large role in the development of the investigative questions and propositions presented in this study. While there is no absolute delineation of each of our questions to a particular success indicator or factor, the spirit of specific indicators or factors can be traced to each question asked. Additionally, while Davenport et al. attempt to prioritize factors by identifying those underlined, this study does not hold the same position, but merely analyzes DoD KM initiatives to see which factors may be present, further indicating their propensity for being considered successful.

This multiple case design focuses on each of the four armed services as a single case with two units of analysis embedded in each case: 1) unit-level KM initiatives; and 2) service-level KM initiatives. The chapter is subdivided by sections that correspond to each of the investigative questions posed in Chapter I. The investigative questions from Chapter I, leads to the necessity to answer the following propositions put forth in Chapter III:

Proposition 1: KM is operationally defined throughout DoD based upon each service's mission, thereby having implications as to how each service practices the discipline;

Proposition 2: KM is important to the DoD and the DoD gains benefits from its practice;

Proposition 3: KM practice has continuously evolved throughout the DoD;

Proposition 4: The civilian sector and the DoD community is replete with examples of successful KM initiatives;

Proposition 5: Metrics for evaluating KM initiatives, if existent, are varied throughout DoD; and

Proposition 6: KM practice in the Marine Corps can be improved with the advancement of an organizational framework to be utilized by USMC knowledge workers.

All data collected comes by analysis of service-level KM education programs, documented unit-level KM practices, and both unit and service-level information portals. The data is then weighed against the indicators of success and critical success factors mentioned above to reach collective conclusions. Additionally, where applicable, we append knowledge flow principles developed by Nissen (2006) to evaluate knowledge flow health and identify potential knowledge flow pathologies among DoD KM initiatives.

A. WHAT IS KM?

In the DoD IM/IT Strategic Plan of 2008–2009, the DoD CIO defines KM as "the systematic process of discovering, selecting, organizing, distilling, sharing, developing and using information, ...providing the basis from which decisions are made and actions are taken." This definition was developed with the help of each service's CIO. In light of this seemingly joint-like process, we want to see how each service defines KM, and whether or not it is in concert with the DoD Strategic Plan. Likewise, defining KM leads us to posit that an operational definition of KM is in concert with critical success factor 5 in table 4; presenting a clear language and purpose for the initiative.

1. Air Force

"Knowledge Management (KM)—The handling, directing, governing, or controlling of natural knowledge processes (acquire/validate, produce, transfer/integrate knowledge) within an organization in order to achieve the goals and objectives of the organization (JP 6-0). KM seeks to make the best use of the knowledge that is available to an organization, creating new knowledge, and increasing awareness and understanding in the process. KM can also be defined as the capturing, organizing, and storing of knowledge and experiences of individual workers and groups within an organization and making this information available to others in the organization" (AFPD 33-3, 2006).

2. Army

"Knowledge Management (KM) supports the creation, organization, application and transfer of knowledge to facilitate situational understanding and decision making. It is a structured approach to transfer Soldier experiential knowledge in order to give commanders and Soldiers a major tactical advantage on the battlefield" (AR 25-1, 2005).

3. Marines

"Knowledge Management (KM) is defined in reference (f) as the integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase organizational performance. This operational function, advocated by Marine Corps Combat Development Command (MCCDC), enables organizational learning to improve mission performance" (MCO 5400.52, 2010).

4. Navy

> Knowledge Management, as defined by the DON CIO, is the integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase organizational performance.
>
> DON KM has Four Initiatives:
>
> 1.Broaden awareness
>
> 2.Broad implementation
>
> 3.Proliferate KM lessons learned
>
> 4.Build new implementation programs and share KM resources
>
> Two levels:
>
> 1.Enterprise-wide process improvement
>
> 2.Day-to-day operations at the command level (Memo, DON KM Strategy, 2005)

Davenport et al. (1998) state that, "knowledge managers must address the language issue in a way that fits their culture." They go on to imply that those companies that avoid the language issue go on to experience difficulty with their KM efforts because the culture of the organization never accepts that KM deals with complexity and uncertainty. This definition for the Air Force certainly presents clear language, and most importantly it provides a purpose for this initiative. The definition is in concert with the DoD Strategic Plan, and it shows that KM is to be utilized to accomplish organizational objectives. The definition provided seems to focus more on organizational processes and less on unit-level implementations. It is broad in nature but seems to effectively communicate the objectives while addressing the language problem head on. The Army definition is clear, concise and provides an objective for its KM initiative(s). The definition appears to be in concert with the DoD Strategic Plan especially in its discussion of facilitating decision making and gaining a tactical advantage. The Marine Corps, unlike the other services, does not provide its own definition of KM, rather it adopts the definition of the Navy. While upon first appearance this seems to show less of a perceived importance with KM adoption by the Marine Corps, it is elaborated on in the Marine Corps Order that the Director, Command, Control, Computers, and Communication (C4), who serves as the Marine Corps CIO, is also the DoN Deputy CIO Marine Corps, and reports directly to the DoN CIO. With this understanding, we find that KM holds no less importance to the Marine Corps with regard to the other services, only that there seemingly lacks a necessity to have to reinvent the wheel and redefine a concept that has been already defined well by the Navy, and the other branches of service. The definition provided by the Navy is by far, the most comprehensive provided by all of the services with its discussion of integrating KM practices with technology for the purpose of exchanging operationally relevant information and expertise (knowledge) across the organization. While the language issue does not seem to be addressed by the Navy, as warned by Davenport et al. (1998) stating, "normal business language gives the impression of being fact based, often drawing on military and natural science metaphors," the strategy for implementation laid out by the Navy is actionable, believable, understandable, and most importantly able to be carried out, as it articulates four

initiatives and two levels of implementation. The Navy strategy with its "centralized vision and decentralized execution" should enable it to overcome any perceived cultural issues associated with its avoidance of abstract language associated with KM in its definition.

Nissen (2006) states that, "Culture, trust, and incentives affect organizational learning, hence, performance as much as process, technology, and training do." Of the four definitions provided above which states each service's purpose for pursuing KM initiatives, we see that only the Navy seems to address issues involving organizational learning in its articulation of a robust KM strategy. While definition alone is not enough to make a conjecture about a service's KM strategy, the effort put forth by the Navy to explain its strategy upfront goes a long way toward developing a knowledge-friendly culture (critical success factor 4), making it easily understood at both the organizational and unit levels, how KM will be practiced. Defining KM organizationally is extremely important, as it sets the tone throughout the organization as to whether the initiatives are exploratory and potentially short-lived in nature, or if the efforts are truly intended to be culture changing and organizationally embedded. In short, this study cannot conclude that defining KM is mission-oriented, or whether or not how they define KM, positively or negatively affects how the services are practicing KM. However, later in this study we see how decentralized efforts at KM adoption are absolutely mission-oriented.

B. WHAT IS THE IMPORTANCE OF KM TO DOD?

The DoD IM/IT Strategic Plan of (2008–2009) deems information as a strategic asset and goes on to articulate that we will, "use information sharing to enable effective and agile decision making through visible, accessible, understandable and trusted data and services - when and where needed." In an effort to improve its information sharing capabilities, DoD has adopted KM as a practice to help establish a better information sharing environment. KM can be seen as an important part of the transformation DoD is making towards harnessing the power of information superiority stating that, "a KM capability can further advance information sharing" (DoD IM/IT Strategic Plan, 2008/2009). Maule (2006) states that, "knowledge management is a serious area of

inquiry in the military…given the life-threatening situations modern warriors confront and the new types of behaviors exhibited in conflict, knowledge systems have become a priority area." This is evident by the number of KM initiatives taken on by organizations throughout DoD today. In terms of goals for KM, the military and private sectors share similar interest such as improved decision making, interorganizational communication, cooperation, interaction among team members, cognitive understanding, knowledge capture and knowledge fusion. Therefore, this research uses the amount of content discovered that displays tools and techniques for accomplishing the above listed goals, along with language specific to KM importance used by each of the four branches of service in order to determine the perceived importance of KM to each service.

1. Air Force

The Air Force seems to perceive KM as important. As listed on the Air Force portal, "IM interacts with Air Force knowledge management programs by providing control over the items employed and produced by knowledge-based management activities" (https://www.my.af.mil/faf/FAF/fafHome.jsp). The Air Force Center of Excellence for KM lists the following KM goals:

> Decision Quality Information
>
> Provide Airmen and Commanders with access to the intellectual capital necessary to make timely, informed decisions required to achieve desired effects and to sustain the momentum of battle
>
> Transform Military Functions
>
> Institutionalize knowledge creating collaborative policies, processes, and capabilities ensuring tacit knowledge flow, innovative warfighting strategies, concepts, and priorities
>
> Retain “Corporate” Skills
>
> Connect people-to-people, to enable tacit and explicit knowledge sharing, learning, integration, and knowledge transfer critical to Air Force knowledge superiority

Accelerate Learning Processes

> Develop innovative knowledge practices and capabilities that enable Airmen, organization leaders, and Commanders to capitalize on state of the art IT infrastructures and tools provided through Knowledge Based Operations (AFMC Briefing, 2001)

Air Force Knowledge Now, the Air Force's organizational KM system, is the major program utilized to accomplish the goals of interorganizational communication, cooperation, interaction among team members and knowledge capture. The figure below shows how Communities of Practice (CoPs) will be utilized to implement the goals.

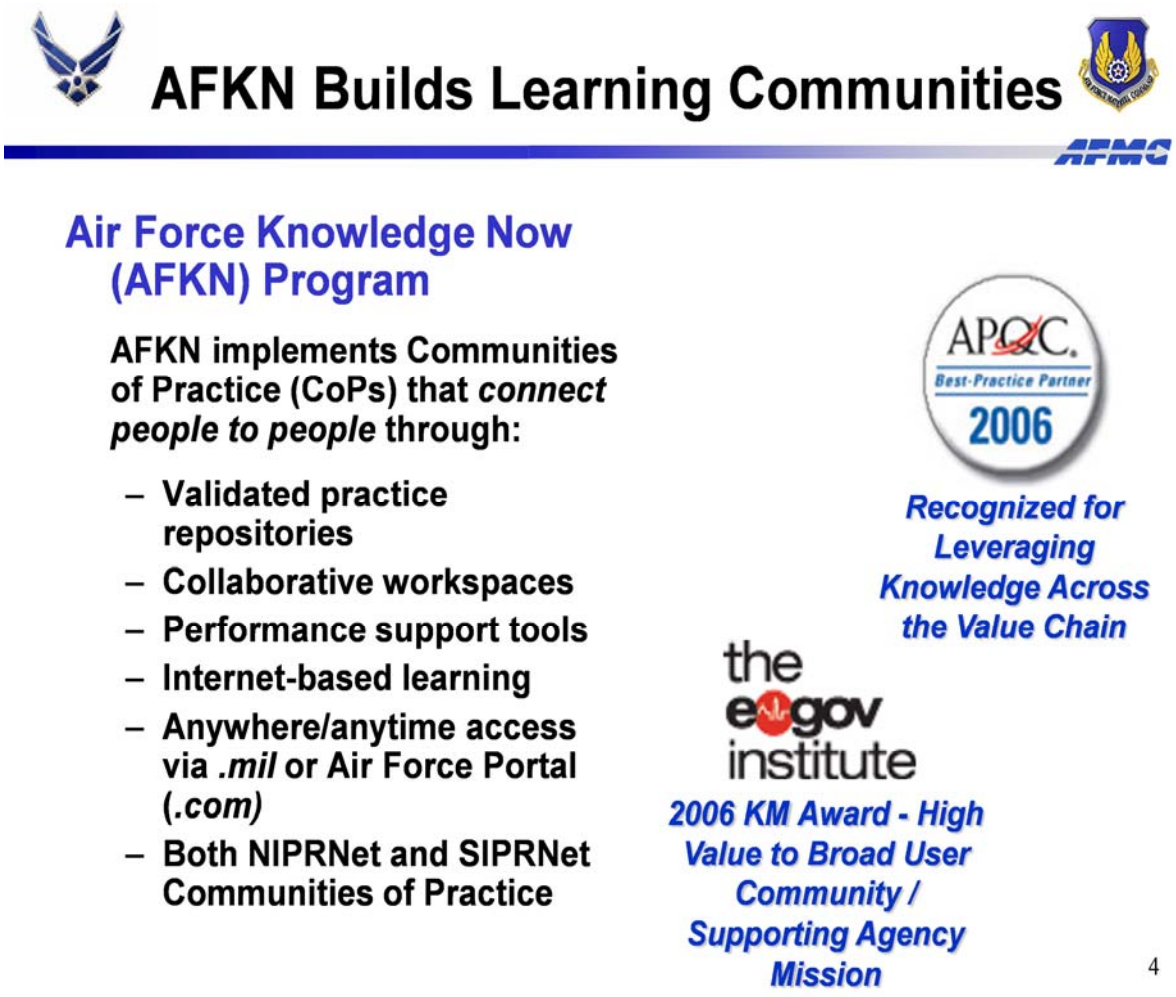

Figure 8. AFKN Build Learning Communities (from AFMC Briefing, 2001)

HQ AFMC/A5BK provides expertise in management of information & knowledge. Focuses on providing two kinds of services to the Air Force:

Customized and tailored knowledge management solutions that facilitate the execution of mission objectives and strategic goals.

Consultative assistance in design/implementation of knowledge-centric solution sets (AFMC Briefing, 2001)

2. Army

The Army seems to perceive KM as important. Not only does the Army operate the Army Knowledge Online (AKO) portal, but the Army has also has a subordinate organization of the U. S. Combined Arms Center (CAC), who, "develops and implements knowledge management products and services that support collaboration among Soldiers and units" through a KM implementation known as the Battle Command Knowledge System (BCKS) (http://usacac.army.mil/cac2/bcks/Intro.asp). Specific objectives listed for BCKS are:

Enable Battle Command — Support virtual collaboration to facilitate the timely exchange of knowledge to enhance situational understanding, learning and decisionmaking. Assist in unit's preparation for deployment by enabling virtual Right Seat Rides (vRSR).

Enhance Professional Education — Oversee the integration of knowledge management practices and expertise to support the establishment of collaborative capabilities across the Operational and Institutional Army.

Facilitate Exchange of Knowledge — Facilitate the establishment and operation of online professional forums. Support the implementation of secure, standardized knowledge management practices.

Foster Leader Development — Provide collaborative professional forums in order to assist and support the Army's training and education process to develop adaptive leaders. Enable sharing of experience and expertise to help develop intuitive decisionmaking.

Support Doctrine Development — Enable collaborative doctrinal discussion capabilities.

> Support Lessons Learned — Provide knowledge management expertise and best practices to assist the Center for Army Lessons Learned as it collects and shares Observations, Insights and Lessons Learned.
>
> **Support Training** — Support the collaborative development of relevant online training scenarios based on current combat experiences (http://usacac.army.mil/cac2/bcks/Objectives.asp)

Army Knowledge Management, via its service portal, explicitly states the importance of KM to the Army stating, "Operating in an environment of growing complexity and uncertainty, today's Soldiers need the ability to rapidly access information, transfer knowledge and win the learning competition with 21st century adversaries. The side that learns and adapts the fastest gains important advantages" (http://usacac.army.mil/cac2/bcks/WhyKMImportantArmy.asp). The Army even goes a step further in clarifying KMs importance to its soldiers by providing the following list of expected benefits:

> Reduce the time needed to resolve specific technical or leadership problems and challenges.
>
> Significantly shorten the learning curve by providing access to relevant online subject matter experts and mentors.
>
> Help create innovative/breakthrough ideas and tools for the benefit of all.
>
> Transfer best practices from one individual to another in near real-time.
>
> Decrease negative outcomes for first-time real-world contact experiences.
>
> Reduce the cost of mission accomplishment through superior knowledge transfer.
>
> Fill the knowledge gap between doctrine and TTPs learned at Training and Doctrine Command (TRADOC) schools and the practical application in a fast changing environment.
>
> Harness the collective minds of the military profession to generate "on the fly" knowledge as needed
> (http://usacac.army.mil/cac2/bcks/WhyKMImportantArmy.asp)

3. Marines

To date, there is no USMC Knowledge portal that has been fully deployed. However, KM is perceived to be important to the Corps, as it is openly practiced by several commands. The institutionalization of KM practices is quite new in the Marine Corps. A recent Marine Corps Order, dated Jan 5, 2010, has been issued which at least adopts the Navy's definition of KM, and accepts its practice as an operational function that enables organizational learning and improves mission performance. In its attempt to adopt KM practices that support interorganizational communication, cooperation, collaboration and knowledge capture the Corps is investing in the development of a virtual work environment and organizing CoPs to encourage and facilitate knowledge sharing. To this end CoPs are expected to contribute by providing support through three focus areas:

Collaboration

Identification of best practices

Support community for deployment issues

Education

Brown Bag-style demonstrations

Electronic resources

Facilitated training

Cohesion

Recognition of CoP practitioners

Standardized approaches

Command-wide resources (MCCDC KM CoP Briefing, 2010)

Microsoft (MS) SharePoint is the chosen technological agent that is driving this collaboration effort. Figure 9 depicts the importance of this effort to the Marine Corps as it illustrates the aggressive timeline for implementation of this KM initiative.

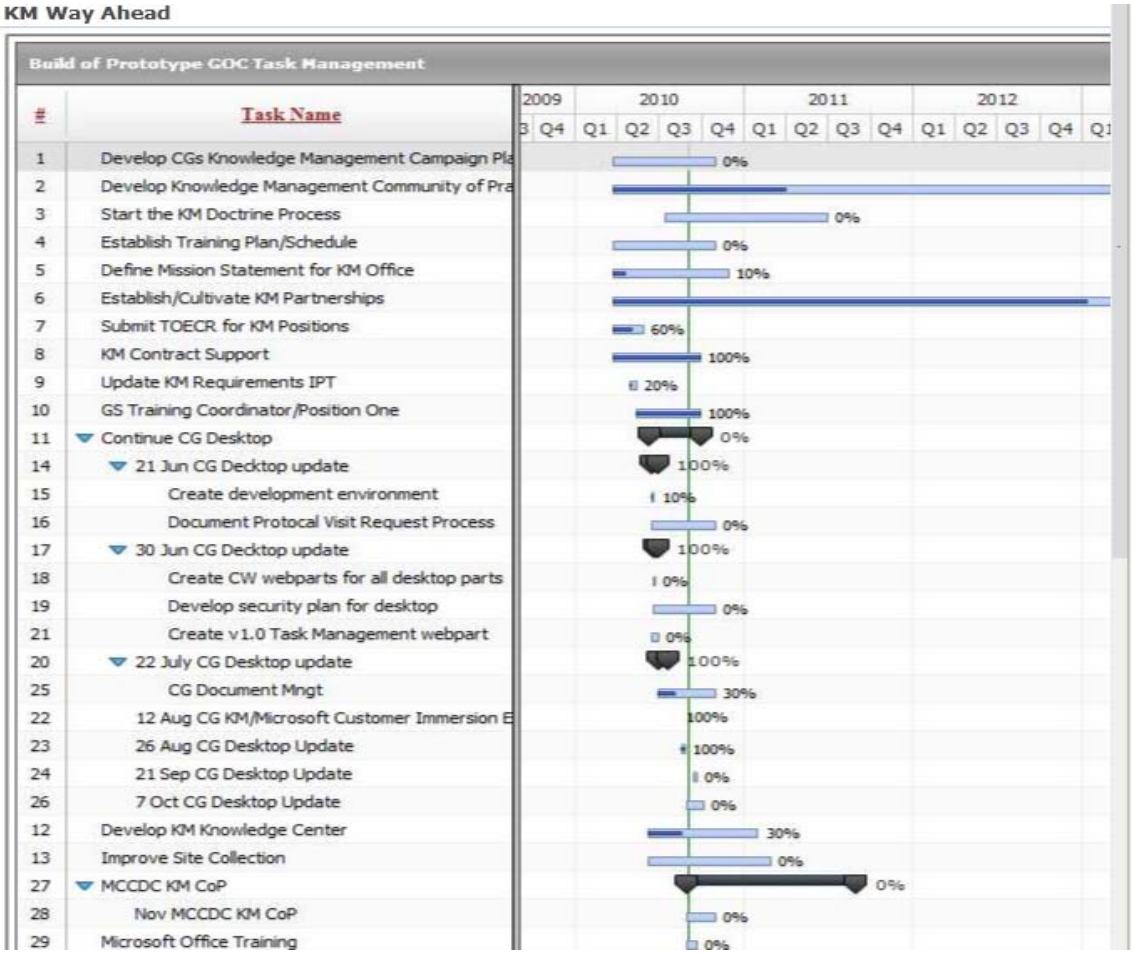

Figure 9. USMC Way Ahead (From United States Marine Corps Combat Development Command, 2010)

4. Navy

The Navy seems to perceive KM as important. The Navy Knowledge Online (NKO) portal is the technology hub that integrates all of the Navy's KM initiatives. Offering a more concise explanation of the DON CIO KM Strategy, via the NKO portal, the DON CIO website publishes the following statement,

> The DON CIO promotes and assists in advancing knowledge management implementation within the Department, which involves supporting and promoting a community of practice, conducting semi-annual meetings and providing tools to facilitate learning organizations. (http://www.DoNcio.navy.mil/ContentView.aspx?ID=633)

Resources abound on the NKO portal; specifically organizing varying Communities of Interest (COIs) into Knowledge Centers. The importance of KM to the Navy is stressed in its two focus areas of implementation: 1) KM Advocacy, in which the DON remains committed to enabling mission accomplishment through KM efforts; and 2) Training and Education, where the Navy is providing organization wide training such as the Afloat Knowledge Management Course, The Command Knowledge Management Course, a two course series on knowledge management through the Naval Postgraduate School, and Navy E-learning via the NKO portal. Additional instruction on KM principles are being incorporated into all levels of formal education discussing topics like CoPs, KM Collaboration, KM Integration and Related Initiatives, and KM Technology tools.

Nissen (2006) states that, "Knowledge management involves organizational change." In concert with the DoD IM/IT Strategic Plan of (2008-2009) in which the objectives of KM are to 1) create a knowledge sharing environment; and 2) "Apply knowledge sharing (e.g., lessons learned) during the planning of joint experiments, operational concept development, combat operations and other missions," each of the services is successfully implementing KM to enhance organizational change efforts. In the following section we see examples of lessons learned, case experiences, and practical KM solutions at the organization and unit levels, further emphasizing the importance of KM to DoD.

C. WHO HAS DEVELOPED KM PROGRAMS WITHIN DOD?

The following table summarizes examples of organization and unit level KM initiatives actively being implemented throughout DoD, as well as components of each program that contributes to the development of knowledge sharing environments.

	Air Force	Army	Marine	Navy
Service Level Programs	Air Force Portal Air Force Knowledge Now (AFKN)	Army Knowledge Online (AKO) Portal Defense Knowledge Online (DKO) Portal Battle Command Knowledge System (BCKS)	MarineNet (Learning Portal) Marine Ammunition Knowledge Enterprise (MAKE) Marine Corps Combat Development Command (MCCDC) KM Center	Navy Knowledge Online (NKO) Portal Enterprise Knowledge Management (eKM)
Unit Level Programs	Air Force Materiel Command 77 Weapons Squadron > 15K Virtual CoPs	1st Cav Division 4th Infantry Division US Army Reserve Affairs Center for Army Lessons Learned (CALL)	Marine Corps Center for Lessons Learned (MCCLL) Ammunition Knowledge Management Portal MCCDC KM CoP	Naval Education Training Command Naval Personnel Development Command US Pacific Fleet Naval Postgraduate School (NPS)
KM Education Offered	AFKN Workshops AFKM 101 Intro to KM AFKN FM KM Overview AFKN CoP Training AFKN Wiki Training	Basic KM Course Battle Command Officer Integration Course Army Knowledge Management Qualification Course MS Sharepoint Adobe Connect	Under Development	CoP Courses (7) IPTR: Knowledge Distribution, Knowledge Flow, and Organizational Performance (KM) Navy Afloat Knowledge Managers Course NPS: IS3210 KM in Defense NPS: IS4210 Knowledge Superiority
KM Methodology	Community of Practice Knowledge Centric Operations	Community of Practice AKM Knowledge Advisors	Community of Practice	Community of Practice

Table 5. DoD KM Initiatives

As we can see, there is much evidence to support the notion that DoD is in concert with the success indicators mentioned in table 5 above, namely: 1) growth in resources attached to projects, and 2) growth in the volume and content of usage. Likewise, we see that critical success factor two is achieved in that, the boasting of knowledge and learning portals for each service shows their commitment towards building a technical and organizational infrastructure. The evidence shows that the practice of KM has continuously evolved throughout the DoD. The Marine Corps is relatively new in its endeavor when compared with the other branches. In terms of KM, the Navy has touted terms such as "actionable information and knowledge" and "knowledge superiority" dating back to its Transformational strategy of 2003. The Air Force and Army however have laid out a timeline of their KM efforts on their respective portals. A summary of these timelines can be seen in the following table, further elucidating the fact that KM has indeed evolved throughout DoD.

	Air Force	Army
KM Evolution	1999 - Air Force Materiel Command (AFMC) launches KM initiative 2001 – AFMC KM becomes AFKM 2001 – AFKM adopts CoP methodology 2002 – AFKM has 200 CoPs and 1500 users 2002 – AFKM becomes Air Force Knowledge Now (AFKN) 2004 – AFKN has 700 CoPs and 14K users 2006 – AKFN adopts Knowledge Centric Operations (KCO) concept 2006 – AFKN has > 7K CoPs and > 160K users	1990s- Old Soldiers Bulletin Boards 2000 - companycommand.com 2002 - early CoP (S3-XO Net) 2003 - AKO 2004 – BCKS 2004 – 2006 BCKS grows to over 80K participants 2006 FM 6-01.1 first KM doctrine 2006 – BCKS develops KM training 2007 – present BCKS assists Army units with KM initiatives 2009 – BCKS receives Authority to Operate (ATO) for NIPR/SIPR networks 2009 – 5th Annual AKM Conference

Table 6. DoD KM Evolution

D. WHAT CONSTITUTES SUCCESSFUL KM PROGRAMS?

In Chapter III, the proposition was made that the civilian sector and the DoD community is replete with examples of successful KM initiatives. Through review of each of the service's KM doctrines, strategies, and Web and knowledge portals we come to see that overwhelmingly, each branch of service's KM methodologies and practices are deeply rooted in widely accepted KM theory, as well as being developed and implemented according to industry KM best practices. While it is nice to view timelines to get a snap shot of KM accomplishments, this research seeks to address KM success on what it is enabling, rather than what it has accomplished. In a 2009 Federal Computer Weekly article, Robert Nielson, a knowledge management advisor at the office of the Army CIO, was quoted as saying,

"If you think you've [succeeded in knowledge management], you aren't doing knowledge management" (http://fcw.com/articles/2009/10/16/dod-knowledge-management.aspx).

Perhaps a more appropriate tool of measuring KM success is to measure its maturity. In a recent article in the Electronic Journal of KM, Minonne and Turner (2009) assert that a KM program's degree of progression can be explained via a two-dimensional model in which the level of implementation is dependent, thereby occupying the y-axis, on the information provided by the control system, which will be reported on the x-axis.

The authors argue that organizations should be forward thinking in their KM strategies and thus when planning and strategizing, their picture of the future should be constantly changing and not static. This is why implementations are dependent of the control system, and why the control system should be measuring current performance. In essence, successful KM programs should be measured by assessing the level of maturity in implementing the organizations KM strategy. Table 7 depicts this assessment, as it is observed over five stages ranging from no control to full control being established.

Level of implementation	Maturity Stage	Level of Control
The basics of KM and the difference between it and information management are understood by some within the organisation. The potential benefits and the use of KM have been discussed in some functional areas.	1	No KPIs other than perhaps some qualitative assessment of efficiency in managing knowledge assets.
An intermediate level of *cultural* integration has been achieved. *Organisational* integration remains at a low level and no meaningful *methodical* and *procedural* integration are yet established.	2	A few qualitative metrics developed to control efficiency in guiding the implementation of KM strategy towards the future.
An advanced level of *cultural* integration and an intermediate level of *organisational* integration have been achieved. Only a low level of *methodical* integration is in place and no meaningful *procedural* integration is yet established.	3	Mainly qualitative, but some quantitative KPIs developed to monitor efficiency and some qualitative KPIs to assess effectiveness in the implementation of KM strategy.
An advanced level of *cultural* and *organisational* integration as well as an intermediate level of *methodical* and *procedural* integration has been achieved.	4	Qualitative and quantitative KPIs in place to monitor the implementation of an effective and efficient KM strategy to take the organisation in the direction of its perceived future image.
An advanced level of all forms, *cultural*, *organisational*, *methodical* and *procedural*, integration has been achieved. The organisation has reached world class status.	5	KPIs, both quantitative and qualitative, in place to measure changes in the image of the future and frequent reassessment of KM strategy to reflect changes in that image

Table 7. Stages of Implementation and Control Security (from Minonne and Turner, 2009)

Below we give our assessment of the maturity of the overall KM initiatives of each branch of service in relation to the table above.

1. Air Force

The maturity Air Force KM is rated at a 5. The basics of KM are taught through the Air Force Knowledge Now system via the Air Force Portal. The courses go into great detail explaining not only the differences between data, information and knowledge, but they also discuss benefits that come by using KM. Advanced levels of cultural integration has been achieved as evidenced by the more than 7000 CoPs that have been formed and managed by AFKN, one of which is also an after action CoP, which collects and makes available quarterly newsletters and reports from around the Air Force. Organizational integration appears to be at an advanced level as the Air Force Materiel Command is committed to management of the Air Force's knowledge base as it, "Increases access, collaboration and use of content in existing knowledge, information and data repositories integrated with increased access to the experience, expertise and practices of the Total Force (active, reserve, guard and civilian)" (Air Force KMCPI Brief, 2001). In terms of methodical integration, the Air Force is quality and productivity of knowledge workers is enhanced through pragmatic document management, as well as the holding of AFKN workshops to assists units throughout the Air Force meet their KM objectives. The procedural integration of the Air Force is phenomenal. KM is being integrated into business processes and organizational workflows, thereby lessening rework and reducing process time. The catalyst for this procedural integration is the conceptual implementation of the Knowledge-Centric Organization (KCO).

2. Army

The maturity of Army KM is rated at 5. The basics of KM are certainly covered via the numerous educational briefs and courses conducted by the Army. Through the BCKS an advanced level of cultural and organizational integration has been reached. Culturally, the Army highly encourages the exchange of organizational knowledge as can be evidenced by facilitating collaboration via the BCKS knowledge portals, professional forums, and the capturing, codifying, and redistribution of knowledge performed by the Center for Army Lessons Learned (CALL). Organizational integration has been achieved as BCKS operates a robust content management program. This practice of content

management shows the commitment of the army to the dedicated management of its knowledge base as content managers go about producing content maps while determining appropriate classifications of content being managed. Methodical integration, which seeks to "integrate human and system oriented KM practices into knowledge intensive work processes in such a way as to positively influence organizational performance in terms of quality, productivity, and innovation gains" is probably best demonstrated by Army KM in its practice of both codification and personalization strategies with such programs as its knowledge assessments and mentoring via BCKS with digital storytelling (Minonne and Turner, 2009). In terms of procedural integration, KM has become an integral part of workflows and Army KM continues to reduce process time and rework by adopting practices like, "Make, Take, Integrate, and Sustain," where AKO integration and liaison teams make templates to help identify knowledge gaps, take the templates to the unit and demonstrate its usefulness, integrate knowledge requirements to close knowledge gaps, and sustain the solution by providing reach-back support and full or part-time knowledge management advisors to the unit (http://usacac.army.mil/cac2/bcks/BlendedSolutions.asp).

3. Marines

The maturity of USMC KM is rated at 2. Despite the unit level successes on KM implementation, maturity is based upon the ability of the organization (enterprise) to operationally define KM, produce doctrine, create and implement strategy, and facilitate organizational knowledge creation, storage, sharing, and reuse. The difference between KM and IM is understood by some within the organization, as can be referenced by the latest Marine Corps Order on CIO roles and responsibilities. An intermediate level of cultural integration can be evidenced by the newly formed MCCDC KM CoP, as well as the virtual workspace that supports knowledge sharing and collaboration via their SharePoint interface. Organizational, methodical, and procedural integration efforts are all at low levels and in their infancy, in terms of stages of development.

4. Navy

The maturity of Navy KM is rated at 5. With its widespread teachings on the benefits of KM to the organization, cultural integration has most certainly been achieved as the Navy equips its people for the organization change necessary for KM success. This endeavor is most notable in the Navy's effort to teach KM principles at all levels of professional training. Organizational integration has been achieved as evidenced by the commitment of managing the organizational knowledge base with NKO and also with the Navy Personnel Development Command (NPDC). Evidence of methodical integration seem to be at an advanced level as quality and productivity of KM efforts are constantly evaluated with metrics analysis, ensuring metrics are tied to objectives of their KM processes, and also through content and document management, as well as with mentoring through KM scenarios and procedures such as classroom storytelling, discussion boards, and conferences. Procedural integration also seems to be at an advanced level. KM implementations by numerous Naval commands to include the Naval Education and Training Command (NETC), NPDC, Navy Medicine Manpower, Personnel, Training & Education Command (NAVMED MPT&E), Navy Installations Command, and US Pacific Fleet, all of which have a robust KM strategy, attribute to the realization that KM has been integrated into business processes throughout the Navy.

This study's assessment of KM programs across the DoD is that the Air Force, Army and Navy are all successfully implementing KM at advanced levels. The Marine Corps has plenty of unit level KM successes, however, organizationally, KM is not very mature. In regards to the levels of control, we posit that KM control has been fully established in the Air Force, Army and Navy, in that four compulsory elements of "a predetermined set of targets, a means of measuring current activity, a means of comparing current activity with each target, and a means of correcting deviations from the targets" to ensure that implementation of KM strategy measures current performance and "guides the organization toward its changing image of the futures" in terms of KM (Minonne and Turner, 2009).

E. WHAT METRICS ARE BEING USED TO EVALUATE KM PROGRAMS?

> Organizations should measure what matters. Measuring for the sake of measuring is fruitless and a waste of time. It is important that measures and metrics be developed and collected for the purpose of continuous improvement of knowledge management activities. (APQC, 2003) One method is to collect stories that explain metrics. For example – telling a story of how KM improved organizational efficiency by explaining how metrics were developed, collected and analyzed is extremely valuable. After data is collected, it is important to post the results and analyze them. When we can show leaders and employees that KM Initiatives produced results, this will result in greater buy-in to using those initiatives. (Hoss and Schlussel, 2009)

Inevitably, KM has to be measured to show senior leadership what the results are. It is quite common to equate Return on Investment (ROI), in a monetary sense, to KM initiatives in industry; however, results from a military perspective differ in than DoD is not a traditional profit-making organization. With metrics, it cannot be approached with a one size fits all mentality. There are metrics that are not useful. In military terms, funding lines are tied to performance and efficiency, hence, giving the military commander the ability to prioritize funding to KM initiatives that work, as opposed to those that are stagnate or ineffective. Each branch appears to have studied this phenomenon and list metrics that they find appropriate for their KM initiatives.

1. Air Force

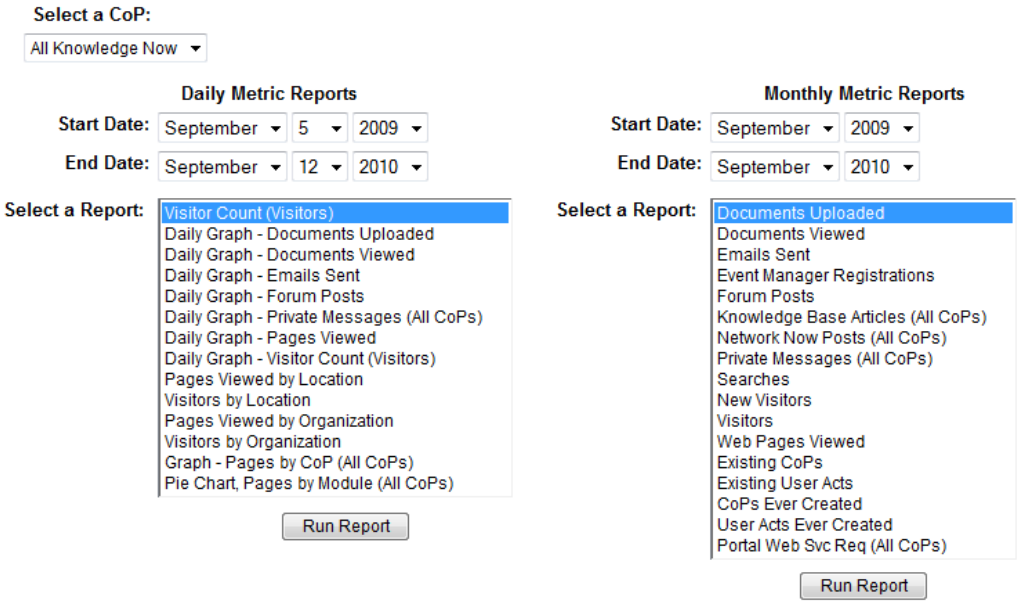

Figure 10. AFKN Metrics (From United States Air Force Portal, 2010)

2. Army

The Army states that, "The most important characteristic of a KM metric is whether it can tell how effectively the knowledge is contributing to understanding and decision-making. A secondary one is whether knowledge is being shared or used." (Army FM 6-01.1 Knowledge Management Section, 2008) To this end, the most common metrics utilized by the Army are: 1) System metrics (page visits, contributions, number of visits); 2) Output metrics (replies to discussions, documents downloaded and used); and 3) Outcome metrics (time/money saved, injuries prevented, changes in the way we do business) (Hoss and Schlussel, 2009). In addition to these metrics, the Army also measures the maturity of it KM programs as evidenced by the figure below.

AKM Maturity Indicator

How KM Mature is Your Organization?

Key Elements of an Integrated KM Program ↓	AKM Principles: People/Culture / Process / Technology KM Novice 1 — 2 — 3 — 4 → KM Mature 5				
Culture **What is the organization's posture towards adopting and applying the AKM Principles?**	❑ Knowledge is power attitude ❑ Little sharing occurs ❑ *Not invented here mentality* ❑ *Change is discouraged* ❑ Systems reside in silos	❑ Knowledge shared within parts of org. ❑ Sharing is not taboo ❑ *Process improvements are considered* ❑ Systems begin to open	❑ Knowledge sharing exists ❑ Sharing is encouraged ❑ *Workers want efficient processes* ❑ Systems balance access and openness	❑ Knowledge sharing is the org. norm ❑ Sharing is expected ❑ *Workers seek & champion improvements* ❑ Systems use robust search	❑ Knowledge shared is power attitude ❑ Sharing is rewarded ❑ *Innovation is encouraged* ❑ Systems cross all boundaries
Strategy **How does the organization implement the AKM Principles?**	❑ No KM strategy or plan ❑ KM not linked to org. success ❑ *Inefficient processes rule* ❑ IT strategy not linked to user's needs	❑ KM strategy emerging and aligning with org. goals ❑ *Process improvement plan developing* ❑ IT strategy considers KM	❑ KM plans and governance model developing ❑ *KM process assessments performed* ❑ IT & KM strategies are linked	❑ KM strategy tied to org. strategy ❑ *KM action plan developed and implemented* ❑ KM strategy drives IT strategy	❑ KM strategic plan in place and in use ❑ KM drives org. success ❑ *Efficient processes rule* ❑ IT supports workers needs
Competency **How skilled is the organization in applying the AKM Principles?**	❑ No CKO/KMO ❑ Little grasp of KM concepts and methods ❑ *Unsure how to encourage efficiencies* ❑ Little KM tool training	❑ KM champions emerge ❑ Interest in KM training growing ❑ *Workers consider process improvements* ❑ KM tool use considered	❑ KM champions lead initiatives ❑ KM Pros complete KM training courses ❑ *Workers apply knowledge to improve processes* ❑ Tool usage rises	❑ CKO/KMO lead KM efforts ❑ KM training available for all ❑ *All workers seek improvements* ❑ KM tool usage routine	❑ Org. leaders drive KM adoption and use ❑ KM training mandatory ❑ *Continuous improvements* ❑ KM tool usage embedded in org.
Metrics **How does the organization measure the impact of applying the AKM Principles?**	❑ KM is not a factor in org. success ❑ *No metrics to assess KM impact* ❑ Any existing metrics used to measure output not outcomes	❑ The need to measure KM is considered ❑ *KM metrics are used to baseline processes* ❑ Metric tracking options considered	❑ Metrics are considered vital to KM adoption and use ❑ *KM metrics are used to validate KM initiatives* ❑ Metrics track usage and attitudes	❑ Metrics impact KM initiatives ❑ *KM metrics drive process improvements* ❑ Metrics embedded in systems and tools	❑ KM impacts org. success ❑ *Metrics are part of KM strategy* ❑ Metrics mostly measure KM outcomes and are leading indicators

Table 8. AKM Maturity Indicator (from Hoss and Schlussel, 2009)

3. Marines

As discussed earlier, the Marine Corps' KM effort is very new. To date, no documents could be found through its information and knowledge portals to confirm

current metrics usage. Site usage and visitor counts were the only visible metrics being utilized on current USMC KM portals. Therefore, this research admits to not finding sufficient evidence to confirm the status of current USMC KM metrics gathering.

4. Navy

Common measures: These measures can be used for all KM initiatives:

Outcome
- Time, money, or personnel time saved as a result of implementing initiative
- Percentage of successful programs compared to those before KM implementation

Output
- Usefulness surveys where users evaluate how useful initiatives have been in helping them accomplish their objectives
- Usage anecdotes where users describe (in quantitative terms) how the initiative has contributed to business objectives

System
- Latency (response times)
- Number of downloads
- Number of site accesses
- Dwell time per page or section
- Usability survey
- Frequency of use
- Navigation path analysis
- Number of help desk calls
- Number of users
- Frequency of use
- Percentage of total employees using system

KM Initiative	Key System Measures	Key Output Measures	Key Outcome Measures
Best Practice Directory	• Number of downloads • Dwell time • Usability survey • Number of users • Total number of contributions • Contribution rate over time	• Usefulness survey • Anecdotes • User ratings of contribution value	• Time, money, or personnel time saved by implementing best practices • Number of groups certified in the use of the best practice • Rate of change in operating costs
Lessons Learned Database	• Number of downloads • Dwell time • Usability survey • Number of users • Total number of contributions • Contribution rate over time	• Time to solve problems • Usefulness survey • Anecdotes • User ratings of contribution value	• Time, money, or personnel time saved by applying lessons learned from others • Rate of change in operating costs
Communities of Practice or Special Interest Groups	• Number of contributions • Frequency of update • Number of members • Ratio of the number of members to the number of contributors (conversion rate)	• Number of "apprentices" mentored by colleagues • Number of problems solved	• Savings or improvement in organizational quality and efficiency • Captured organizational memory • Attrition rate of community members versus non-member cohort
Expert or Expertise Directory	• Number of site accesses • Frequency of use • Number of contributions • Contribution/update rate over time • Navigation path analysis • Number of help desk calls	• Time to solve problems • Number of problems solved • Time to find expert	• Savings or improvement in organizational quality and efficiency • Time, money, or personnel time saved by leveraging expert's knowledge or expertise knowledge base

Table 9. DON KM Metrics (from DON KM Metrics Guide, 2001)

F. HOW CAN THE USMC KM PRACTICE BE IMPROVED?

To date, the Marine Corps has established a command to take operational control of KM implementation. A definition, albeit the same one used by the DON, of KM has been organizationally defined. KM is perceived to be important to the Corps, as it is openly practiced by several commands. In addition to its development of a virtual work environment, the Marine Corps seems to be adopting a similar methodology of implementing KM through CoPs to facilitate knowledge sharing. Advances in KM education efforts throughout the organization are needed. A USMC KM Strategy must be developed and disseminated, separate of that issued by the DON CIO. An actionable KM Framework must be developed that will help to articulate the knowledge vision of the Marine Corps and further develop its knowledge base in concert with its operational capabilities and mission objectives. These needs will be addressed in the following chapter.

V. CONCLUSION

This research set out to summarize findings of KM best practices, responsible for healthy organizational knowledge flow throughout DoD, and identify knowledge flow pathologies regarding how the USMC is currently addressing KM and how they can overcome these knowledge flow issues and advance its KM practice. Additionally, we delineate knowledge flow vectors in this chapter that help to describe the current state of DoD knowledge and workflow processes along with potential interventions that may assist with improving the learning and doing of USMC knowledge workers. Ultimately, these findings are used to develop a KM framework to be utilized by current USMC information management workers to assist with KM advancement and practices throughout the Marine Corps. Specifically, we want to answer the two research questions presented in Chapter I:

1. How is the DoD currently addressing KM?
2. What steps are necessary for the Marine Corps to advance its KM practice?

A. KEY RESULTS AND INSIGHTS

Table 10 summarizes the DoD KM practices discovered by this research. There is no attempt to order or rank the services in terms of KM practice, but merely represent the findings.

	Air Force	Army	Marines	Navy
KM Defined	Yes - AFPD33-3 28 Mar 2006	Yes - Army Regulation (AR) 25-1 15 Jul 2005	Yes - MCO 5400.52 5 Jan 2010	Yes - DON Memo 20 Oct 2005
KM Perceived Important	Yes - KM goals outlined	Yes - KM goals/benefits outlined	Yes - KM benefits outlined	Yes – KM goals outlined
Indicators and Factors of KM Success	Resource growth Content growth Technical infrastructure Clear purpose Knowledge friendly culture Senior management support Standard, flexible knowledge structure	Resource growth Content growth Technical infrastructure Clear purpose Knowledge friendly culture Senior management support Link to industry value	Resource growth	Resource growth Content growth Technical infrastructure Clear purpose Knowledge friendly culture Senior management support Multiple channels for knowledge transfer
KM Maturity Level	Mature	Mature	Novice	Mature
KM Strategy	Yes	Yes	No	Yes
KM Framework For Implementation	Yes	Yes	No	Yes

Table 10. DoD KM Findings

As previously stated in Chapter IV, we find that the KM practices for the Air Force, Army and Navy are rated at being mature. The current posture of KM practices in these three branches of service did not occur overnight, or by a lack of leadership. Nissen states, "Knowledge exhibits some properties of inertia such as tendency to remain at rest, hence knowledge-flow processes represent direct focuses of leadership and managerial action (Nissen, 2006). Each of the three branches previously mentioned exhibits direct focus from their leadership, as can be evidenced by the listing of the indicators and factors of success found in their respective KM programs. These indicators and factors are largely representative of knowledge-flow processes and activities that, along with the appropriate KM principles, senior leadership as well as KM practitioners, are actively figuring out how to successfully weave into the cultures and operational practices of their services. The research conducted through this study finds that the Air Force, Army and Navy, with their mature KM programs, implementations and practices have reached what we call a Virtuous KM Spiral. The notion is that each organization is able to "maintain an upward spiral of higher and higher performance" as a result of continuous strategizing, value-creation and development of KM implementations that work (Lawler III and Worley, 2006). Figure 11 helps to delineate this spiral.

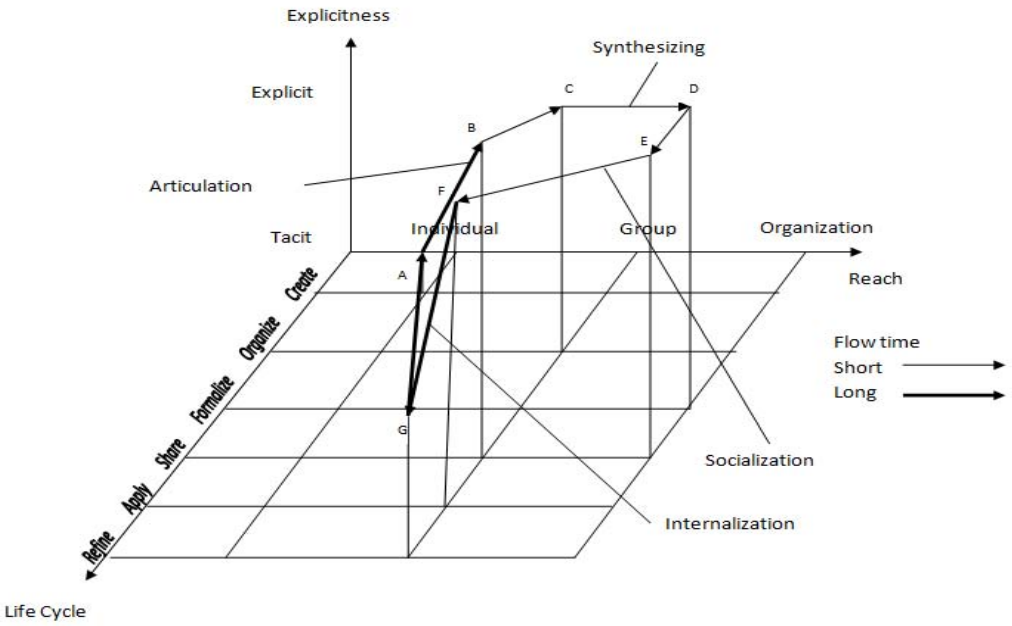

Figure 11. Virtuous KM Spiral

Coordinate A signifies the point an individual creates tacit knowledge. Vector (A→B) represents the individual's conversion of tacit knowledge to explicit knowledge (articulation) and transferring it to the group level for sharing. Nissen (2006) describes knowledge as being "sticky," therefore clumping to an individual and being hard to move. This characteristic of tacit knowledge is shown in terms of long flow time as represented by the bold vector. While little can be DoNe to help speed the process of knowledge internalization (the conversion of explicit to tacit knowledge), the Air Force, Army and Navy have invested in attempts at helping the individual facilitate the knowledge conversion process associated with knowledge externalization (tacit to explicit).

The Air Force's Innovative Development Through Employee Awareness (IDEA) Program encourages the creation and submission of new ideas (innovation) that promote process improvement. All DoD military, civilian employee(s) or contract personnel are provided an electronic medium, the IDEA Program Data System (IPDS), which helps to facilitate the articulation process of converting tacit knowledge to explicit knowledge via a Web-based Air Force application. The Army uses digital storytelling to help facilitate knowledge creation and sharing, which we see as another means of inducing knowledge conversion. While digital storytelling is not completely explicit, as the story remains tacit in form, the narrative engineering platform offered through BCKS allows the story to be recorded (made explicit) if necessary, and further disseminated to allow for sharing within the group. The Navy implements what is known as classroom storytelling, in which tacit knowledge of students is captured, and sent to Distance Support for validation, by instructors because the instructor feels that the details will provide substantial value to operational readiness. Once the articulated knowledge has been vetted and validated by Distance Support, the Navy allows instructors to disseminate the newly validated knowledge (now explicit in nature) throughout its courses of instruction, allowing groups of students, as well as future shipmates to share this knowledge.

Vectors (B→C) and (C→D) represent the "movement of explicit knowledge across the reach dimension" (Nissen, 2006). This movement is happening at a rapid rate as depicted with a narrow vector representative of its short flow time. The major

practices identified throughout this study that facilitate the swift flow of movement is 1) associated with the explicit nature of the knowledge being transferred, as explicit knowledge is characteristic of being supported well by IT; and 2) the use of CoPs. The CoP strategies being implemented by the Air Force, Army and Navy enable timely exchanges of knowledge through virtual collaboration, support communities, collaborative workspaces and most importantly, anytime-anywhere access to knowledge assets.

Vector (D→E) represents a movement down the organization's life cycle of knowledge. Traditionally, the formalization of processes and procedures in DoD happens as the result of a lengthy process of doctrinal publication writing. However, the use of CoPs and social media tools such as wikis has allowed the organization to formalize processes at a much more rapid rate. Because CoPs are formed of subject matter experts in their respective domains, it allows the organization to accept the knowledge shared and created as recognizable and legitimate. Hence, because the information and knowledge developed in these CoPs is accepted as operationally relevant, the organizations are able to move swiftly from knowledge formalization to sharing throughout the organization, largely due to the fact that the need for the organization to organize the knowledge has already been taken care of at the group level. Again, this flow is represented as short flow time with the narrow vector.

Vector (E→F) depicts the movement from explicit organizational knowledge being shared to explicit group knowledge being applied, which again represents strength of the CoP approach, as the organization’s knowledge base continues to grow and sustain itself. Vector (F→G) shows the important movement to knowledge refinement (internalization). The process of converting explicit knowledge to its tacit form happens at the individual level, thus represented by a slow flow time with a bold vector. However, even with this slow individual-based cognitive process, the extensive use of CoPs in the Air Force, Army and Navy helps these branches of service to benefit from the collective internalization of individuals understanding throughout the organization, thus learning and applying important KM principles and practices. Lastly, vector (G→A)

represents a movement back to the individual who has been empowered and incentivized to create new knowledge, which completes the Virtuous KM Spiral.

"Knowledge is not a single, static, monolithic concept. Rather it is multifaceted, dynamic, and multidimensional. Hence, managerial efficacy through intervention can be increased by learning the principles of dynamic knowledge (Nissen, 2006). Summarizing our assessment of the three aforementioned services, the Air Force, Army and Navy are doing an exceptional job of promoting knowledge sharing, connecting those who need to know with those who know, creating and sustaining operational knowledge bases and appropriately weaving KM principles into their organization's knowledge and workflow processes. The Marine Corps, among other organizations, stands much to gain by applying the cross section of KM practices observed in its sister services. Recommendations for how to proceed are provided below.

B. RECOMMENDATIONS

In Chapter II, we asserted that KM is the practice of managing intellectual capital. Closely related to this is the discipline of Business Process Reengineering (BPR) which promotes the managing of change. Any successful KM effort should be expected to blend the complications of managing complex changes in people's behaviors, as well as organizational processes. In reviewing BPR research conducted by Bashein, Markus and Riley (1994), which is centered on preconditions for success, we feel these preconditions are also applicable to KM success. The research of Bashein, Markus and Riley (1994) provides eight preconditions, and Nissen (2006) suggests that three of them are most prevalent today. Nissen summarizes, "through research on numerous re-engineering projects, three obstacles to large-scale change are noted: (1) lack of sustained management commitment and leadership; (2) unrealistic scope and expectations; and (3) resistance to change. Examine any KM project today, and you are very likely to encounter these same obstacles" (Nissen, 2006). Armed with this knowledge, the Marine Corps cannot continue to practice KM with the single approach of enhancing knowledge sharing without addressing the issue of its stagnant knowledge sharing culture. Dual

emphasis must be placed on organizational change and enhanced knowledge sharing through KM, as both are likely necessary to reach advanced levels of KM maturity in the Marine Corps.

Deeply rooted in the review of KM literature, and coupled with thorough analysis of successful KM best practices throughout DoD, we present the Create, Craft, Choose, Promote and Organize (C-3PO) Framework. The framework encompasses the tenets of successful change management, along with KM best practices and activities most likely to bring maturity to current USMC KM practices.

Figure 12. C-3PO KM Framework

1. Create a Vision

"Realistic expectations, shared vision, and appropriate people participating full-time represent the preconditions for success that are absent or insufficient most often in KM projects." (Nissen, 2006) This research has found that a vision for KM in the Marine Corps is non-existent. Recall earlier when it was implied that knowledge possesses inertia and that managerial action is necessary to effectively move it. Vision can serve as the impetus that will promote, and likely induce the behavioral changes desired for

USMC KM workers to be committed to implement the KM vision. With the development of a USMC KM Vision statement, a KM leader emerges for the Marine Corps that will set the tone for KM implementation throughout the organization, as well as those KM workers committed to making the vision a reality. At the time of this research the position of Director of KM Integration remains vacant. In creating this KM vision, the Marine Corps must also ensure that the KM mission aligns with the mission of the Marine Corps, further complementing the Corp's ability to reap desired KM benefits. Finally, a KM vision addresses the issues associated with unrealistic expectations, as the vision can be expected to draw a clear timeline for measuring immediate and future KM successes against. We have already seen a timeline for KM implementation for the Marine Corps, however without vision to measure it against, those implementing KM can easily lose focus, direction and motivation when either missing deadlines or reaching barriers to success.

2. Craft a Strategy

The Marine Corps is no different than any other organization, in that its members share and acquire the knowledge they need to perform their jobs most often in one of two ways: 1) accessing documents; or 2) accessing people. The most appropriate KM strategy for the Marine Corps to adopt is that of a personalization/codification hybrid. Heeding the warning given by Ribiere and Roman (2006), stating that organizations trying to excel at both risk failing at both, the Marine Corp's hybrid approach can be on a situational basis, according to the needs of KM for a particular part of the organization. Hence, those seeking to "collect, codify, and disseminate" information and knowledge should pursue codification KM strategies primarily. Whereas, those seeking to develop networks and link people together for the purposes of tacit knowledge flow should pursue personalization KM strategies principally. It is understood that the Marine Corps as an organization must address both strategies in order to develop both an infrastructure and techno structure necessary to support organization-wide KM, as well as unit-level KM. In doing so, as long as the appropriate organizational processes are targeted, via a well

structured strategy, the Marine Corps can expect to reap bountiful KM benefits by optimally organizing and utilizing its available resources for KM.

Crafting a KM strategy for the Marine Corps should naturally evolve into producing a Concept of Operations (CONOPS) with which the Marine Corps can articulate the understanding of its knowledge gaps and the scope with which its KM efforts will target improvements. Another benefit of providing this KM CONOPS is the communication of KM goals and objectives desperately needed to drive the KM effort. Additionally, a KM CONOPS should be expected to provide guidance to subordinate leaders throughout the Corps as it delineates very clear delegations of responsibility. Nissen warns that, "reliance upon external expertise, narrow technical focus, and animosity towards staff and specialists represent the preconditions for failure that are present or sufficient most often in KM projects" (Nissen, 2006). If the Marine Corps doesn't develop a KM strategy and CONOPS to drive implementation, it certainly jeopardizes its own success at KM, as the Corps does not have the in-house KM expertise, and at best is currently employing technology to service its knowledge workers that is narrow in focus, likely being utilized to meet today's needs, but lacks any focus on how it may contribute to future KM needs.

3. Choose KM Activities

"Perhaps the greatest potential in terms of a knowledge audit lies in the prospect of measuring knowledge inventory." (Nissen, 2006) The value of a knowledge audit cannot be understated, as it is likely the best way to help an organization learn what it is they truly know, or do not know. Conducting a knowledge audit is also beneficial in discovering knowledge gaps, which would be beneficial in USMC KM, as it would increase the chances of the Corps to get the necessary knowledge to those who need it.

Choosing KM activities wisely is another means of managing KM resources appropriately. A myriad of KM activities being practiced through DoD was addressed in this research. Examples include how the Air Force is developing innovative knowledge practices and capabilities through its "IDEA" program, how the Army is assisting state-side units preparing for future combat deployments with its "Virtual Right Seat Rides"

program, and how the Navy is educating its sailors through its Afloat Knowledge Management Course, which brings the education to its deployed personnel, thereby closing a knowledge gap, and developing KM capabilities throughout Naval commands. The largest similarity among all the previously mentioned KM activities is that they are all tied to advanced and mature organization-led knowledge portals, giving members anytime/anywhere access. This capability does not currently exist in the Marine Corps. The Marine Corps must develop an online knowledge portal in order to advance its KM posture. At best with SharePoint, the USMC KM capability is being limited to those units that are utilizing the product to share knowledge at the intra-unit level. For USMC KM to be effective knowledge sharing must exist throughout the organization, and a knowledge portal that gives access to all Marines, while simultaneously supporting working groups, CoPs, and other communities of interest, will help to induce the flow of knowledge at all levels of command.

The Marine Corps would also benefit from following in the footsteps of the Navy in conducting a strength-weakness-opportunity-threat (SWOT) analysis in order to, "recognize deficiencies in the organization's knowledge position, as well as knowledge strengths that can be leveraged" (Holsapple and Jones, 2006). The major advantage in performing a SWOT analysis for the Marine Corps is that it allows the Corps to tailor its KM efforts to match the unique capabilities provided by the Marine Air Ground Task Force (MAGTF), which is the official organization of how Marines conduct missions across the range of military operations. It is further believed that if the Corps is aware of competitive advantages that exist as a result of its knowledge position, knowledge workers can best be supported with the creation of KM tool kits, providing knowledge workers with a standardized, yet flexible way of implementing KM at the unit level. These KM tool kits would contain KM education for leaders interested in pursuing KM efforts, along with supporting technological tools and training to begin KM implementation for the Corps' most common knowledge-intensive processes.

4. Promote Knowledge Sharing

Across the board, CoPs are being utilized as the KM methodology of choice across the DoD. The Marine Corps is currently forming its first KM CoP, and should continue to pursue and encourage this practice. Benefits gained from utilizing CoPs are mostly associated with increases in social capital. "Culture, trust, and incentives affect organizational learning, hence, performance as much as process, technology, and training do" (Nissen, 2006). CoP utilization offers the Corps the best opportunity of leveraging the benefits of formal and informal means of socialization and human interaction. In other words, it is difficult to promote knowledge sharing in an environment where people do not feel trusted and empowered. Being able to meet in a community of individuals with similar goals and pursuits helps to alleviate trust issues often associated with not wanting to reveal a lack of knowledge around senior leaders. Additionally, the Corps must improve at recognizing efforts undertaken by knowledge workers. The Air Force, Army and Navy are replete with examples of KM awards that are disseminated throughout their organizations. Finally, as with systems in the past, the Marine Corps has to be careful to not only bolster efforts at knowledge sharing in garrison commands, as often times it is the individuals or groups operationally deployed, without a means to reach back for support, who are in need of collaboration tools. In this regard, KM collaboration tools funded and appropriated should be planned for usage by garrison commands, as well as those units beyond the wire.

5. Organize KM Processes Around Strategy

The goal of improving the posture of USMC KM practice must transcend beyond simply being able to state that the Marine Corps is doing KM. The ultimate goal must be measured in terms of facilitated knowledge transfers, increasing knowledge bases, and the retention and development of intellectual capital. To ensure that USMC KM is accomplishing this, there needs to be a constant assessment of what USMC KM processes are achieving. The KM processes must be organized around the KM strategy. To ensure that KM leaders do not lose sight of this, KM processes involving both forms of knowledge (explicit and tacit) must be examined in relation to the KM strategies being

pursued. With the Marine Corps seemingly moving forward with KM activities, as it should, leadership should be cautioned not to put the cart before the horse with the purchasing of promising technologies, and formalization of KM practices not vetted against a viable KM strategy. Ultimately the strategy must provide the basis for which technologies and practices of USMC KM processes will be organized around.

C. SUGGESTIONS FOR FOLLOW-ON RESEARCH

This research has provided a summary of realized DoD KM best practices, as well as formulation of a framework that the Marine Corps can utilize to bolster its KM efforts and close the gap of KM practice between its sister services. This research does not claim completeness in either realized best practices or its culmination of an actionable KM framework. Follow-on research could include more quantitative methods of identifying DoD KM best practices through the use of surveys to the entire population of DoD KM practitioners.

Further research could be conducted on the development of specific KM tools used to promote collaboration and knowledge sharing through social media among deployed USMC knowledge workers. Nissen (2006) believes that socialization and acculturation are viable approaches towards enhancing knowledge flows. Knowledge flows that are facilitated by social media offer promise in bridging the dynamics involved with KM and social networks.

Finally, this research only focused on KM initiatives among the Air Force, Army, Marines and Navy, and did not include any analysis of KM initiatives in the Joint and Coalition arenas, non-military government institutions or business organizations. Considering the net-centric environment of today's military and the ever expanding number of joint missions, a thorough analysis of joint KM initiatives may provide insight into ways of expanding KM practice throughout the DoD. Moreover, given the increasingly tight integration of military, government, corporate and non-profit organizations in coalition operations, looking beyond the military is prudent as well. It is important, nonetheless, to understand that the Marine Corps is different in many respects—and similar in other respects—from other organizations. Hence USMC KM vision, strategy and implementation will likely reflect a mix of unique and common elements.

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